

SERVICE MANUAL

STEREO TURNTABLE

 **SANYO**

PLUS Q60



SPECIFICATIONS

NOTE : Parts mentioned in the following list vary in Part Number according to Territories.

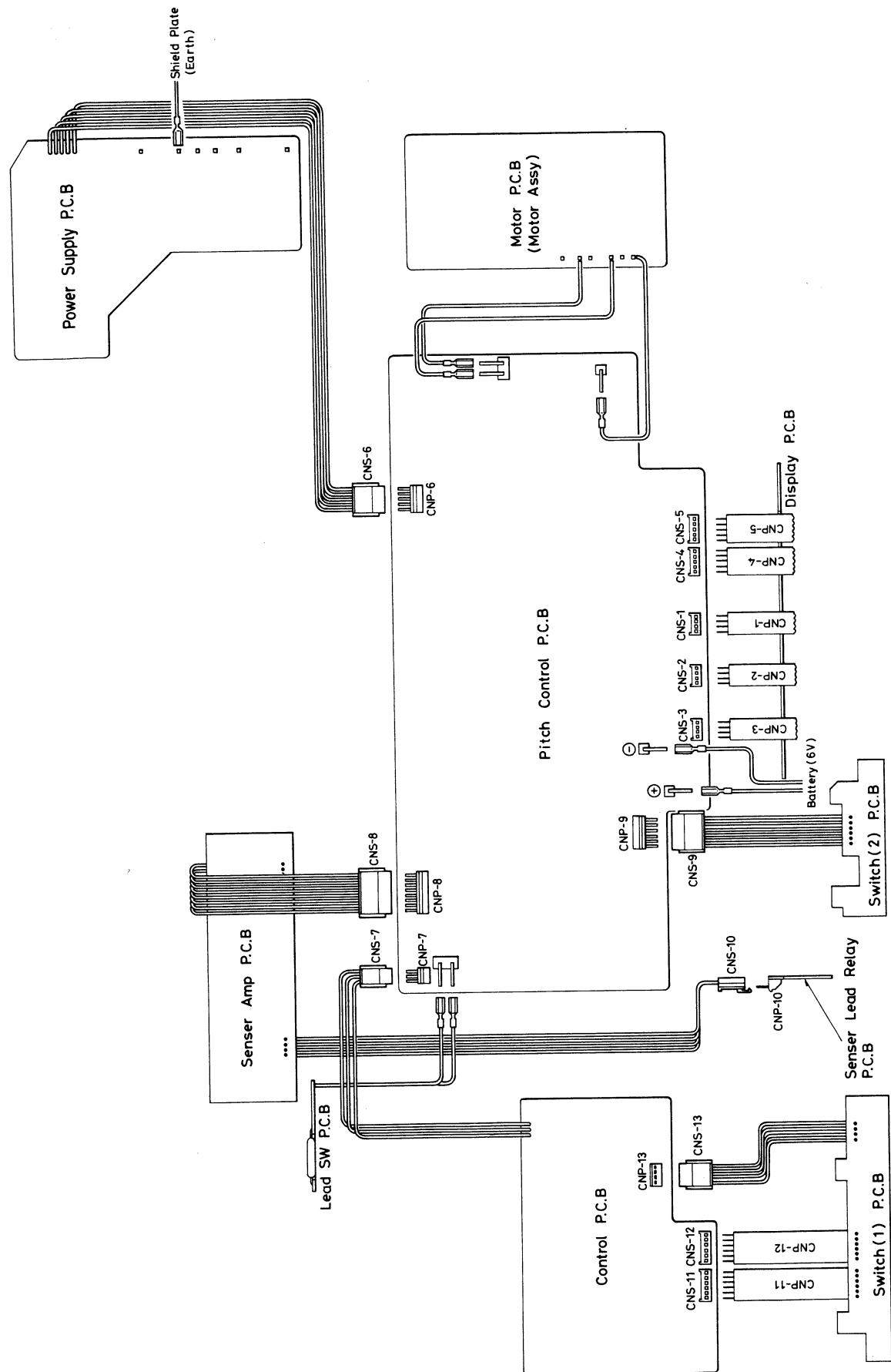
Motor	Quarts PLL brushless servo motor (turntable platter)	Tracking error	±1.5°
Drive system	DC motor (tone arm)	Overhang	15 mm
Speed	Direct drive/Full auto	Frequency response	20 – 20,000 Hz
Wow and flutter	33-1/3 and 45 rpm	Channel separation	Better than 25 dB
Rumble	Less than 0.025% WRMS	Power source	AC: Local Voltage
Turntable platter	–73dB DIN B spec	Power consumption	17 W
	312 mm (12-1/4"), 1.5 kg (3 lbs. 3 ozs.)	Dimensions (Approx.)	440(W) x 372(D) x 154(H) mm (17-1/4" x 14-5/8" x 6")
Tone arm	Static-balance type (Carbon fiber)	Weight (Approx.)	9.5 kg (20 lbs. 14 ozs.)

* Specifications and design are subject to change without notice.

NOTE:

* To lubricate the turntable, please consult your nearest SANYO agent.

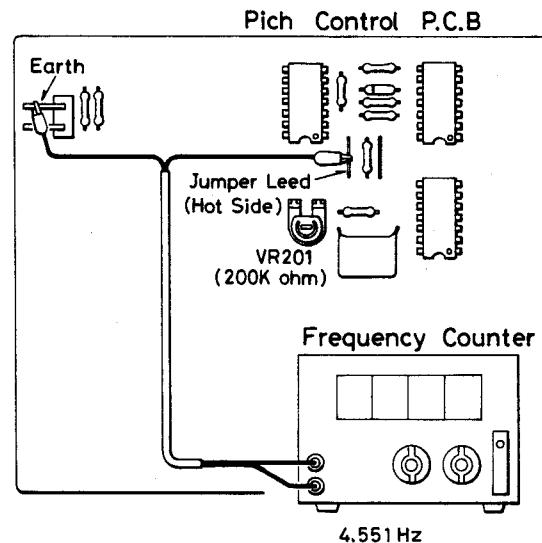
CONNECTION CHART



CIRCUIT ADJUSTMENT

1. Adjustment of Reference Oscillator

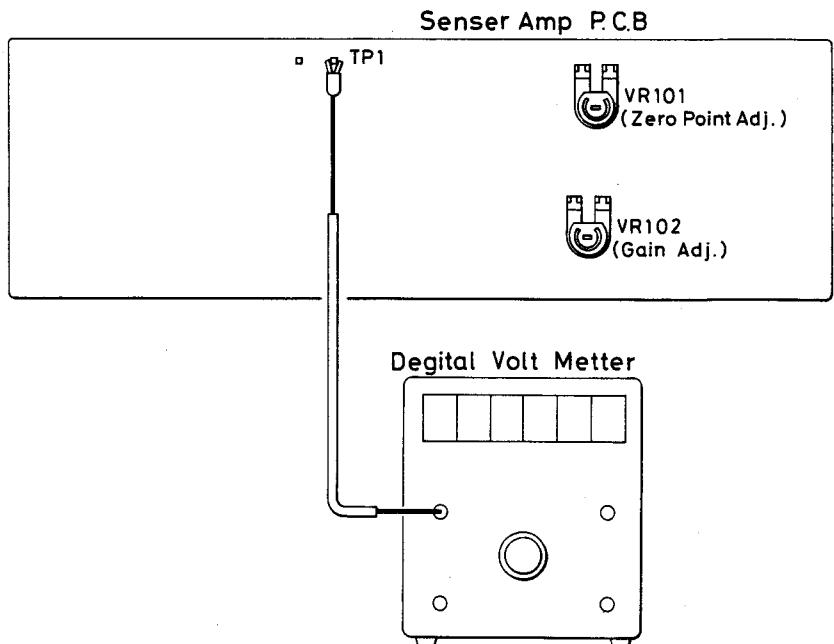
- * Connect the measuring terminals of the frequency counter to the test point (see the attached figure) of the pitch control PCB.
- * Turn ON the power switch of the set. Next, adjust the semi-fixed volume (variable resistor) VR201 (200K ohm) to set it with the following frequency: Adjusting frequency: 4.546 ~ 4.556Hz (Center frequency: 4.551Hz)



2. Adjustment of Stylus-force Gauge Sensor Amplifier

Note 1: Turn ON the power switch of the set to keep the set in the energized state for ten minutes.

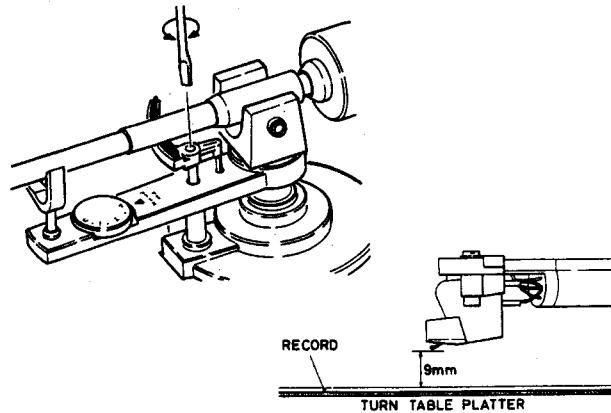
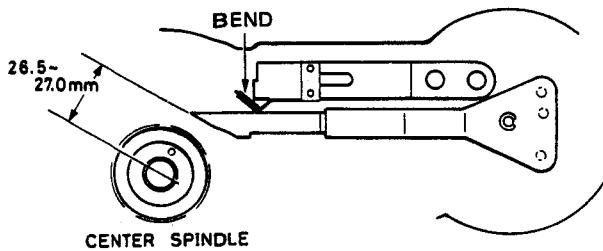
- * Connect the digital voltmeter to the interval between the test point TP-1 and earth of the sensor amplifier PCB. (See the attached figure.)
- * Adjust the semifixed volume (variable resistor) VR101 (20K ohm) to set the indicating value of the digital voltmeter to 0.000V. (Adjustable to within the range of indicating value $\pm 0.005V$) (Zero-point adjustment)
- * Place a weight (1.5g) provided to the set on the needle pressure gauge, and adjust the semifixed volume (variable resistor) VR102 (10K ohm) so that the needle pressure indicating value of the set will become 1.5g. (Gain adjustment)
- * Remove the weight, and read the indicating value of the digital voltmeter. If this value is found within $\pm 0.005V$ range, adjustment is over.
- * However, if found outside of $\pm 0.005V$ range, perform adjustment again from zero-point adjustment of the second step.



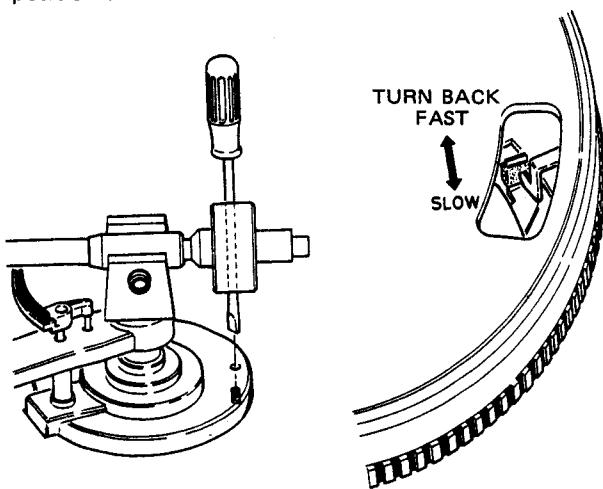
MECHANISM ADJUSTMENT

ADJUSTMENT OF AUTO-RETURN

1. Adjust the stopper (56) so that the shortest distance from the center of the center spindle to the lever (M2) becomes 26.5 – 27.0mm.

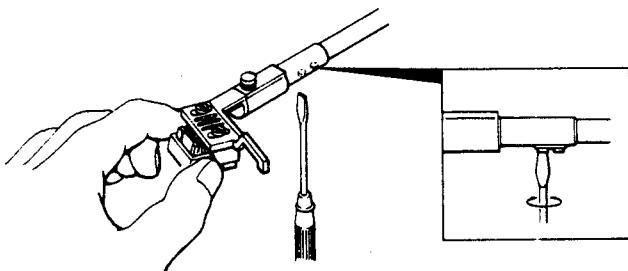


2. There is a shaft which is accessible with an ordinary screwdriver through the hole below the tonearm. (See illustration at right.) When the stylus has reached a point approximately 55mm from the turntable center, turn the shaft clockwise or counterclockwise and select a position where it actuates the auto-return.



ADJUSTMENT OF HEADSHELL

The headshell attached to the tonearm should not be inclined either to the right or to the left. If necessary, loosen the two screws on the bottom of the tubular arm and adjust the headshell. Be sure that the stylus is normal to the record surface.

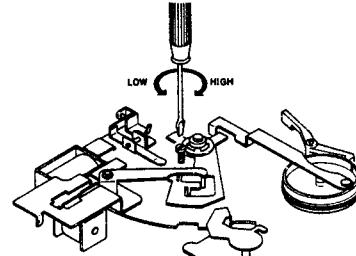


ADJUSTMENT OF TONEARM LIFTER

Depress the cueing button, and turn the screw (Y4) of the arm lifter (P) to adjust so that the distance between the stylus and the record surface becomes 9mm when the stylus of the arm moves up near the outer circumference of the record.

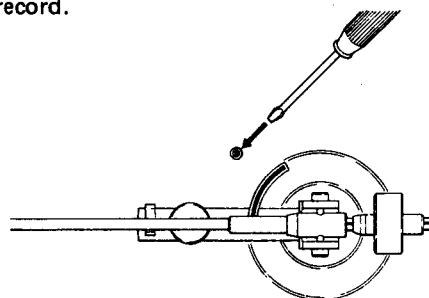
ADJUSTMENT OF LIFT-UP LEVER SPRING

Switch off power when the auto-return has worked and adjust spring tension to provide a clearance of 11mm between the stylus and the record. In this adjustment, the lift-up lever will go up if the screw (M6) is turned clockwise.



ADJUSTMENT OF STYLUS SET DOWN

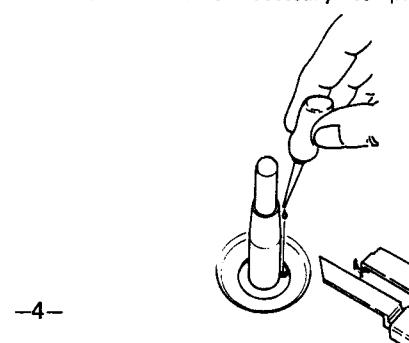
Adjust the position the stylus comes down in an auto play. Adjust the lever (M43) shaft so that the needle comes down at the position of 147mm apart from the center of a 12" record.



REPAIR

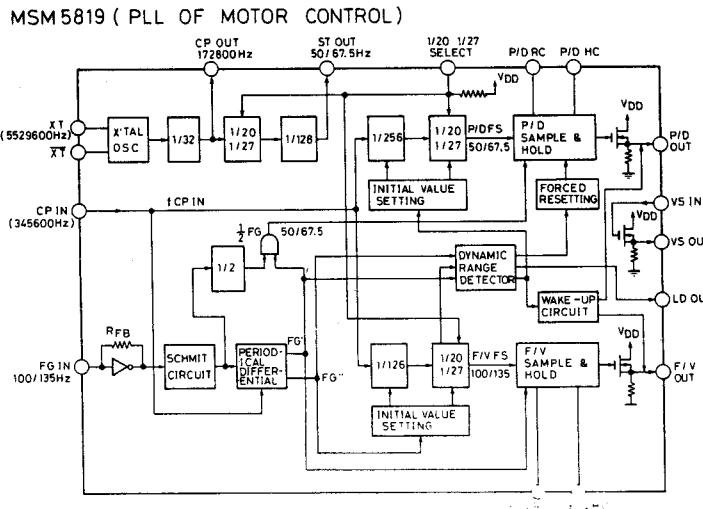
Dismount the turntable platter and supply two to three drops of oil into the D.D. motor through the hole in the motor housing.

Be careful not to stain any exposed part with oil. This caution is necessary to prevent operating trouble.



IC BLOCK DIAGRAM

MSM 5819



Description of Performance

1. Output signals F/V OUT, P/D OUT are set in the three states as shown below.

(1) Lock state

Both F/V OUT and P/D OUT provide normal performance, and the lock indicator (LD OUT) becomes "H" level (V_{DD}).

Lock range:

33 1/3 rpm $\pm 3.7\%$ of reference signal period T

45 rpm $\pm 5\%$ of reference signal period T

(NOTE)

$$\text{Reference signal period } T = \frac{1}{f_{CPIN} \times \frac{1}{128} \times (\frac{1}{20} \text{ or } \frac{1}{27})}$$

(2) Underspeed

Both F/V OUT and P/D OUT become "H" level (V_{DD}), and the lock indicator (LD OUT) becomes "L" level (GND).

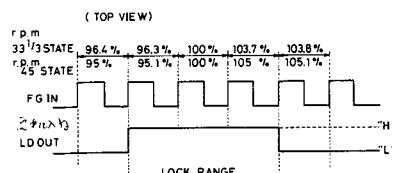
(3) Overspeed

Both F/V OUT and P/D OUT become "L" level (GND), and the lock indicator (LD OUT) becomes "L" level (GND).

The relation between LD OUT and lock range is as shown below.

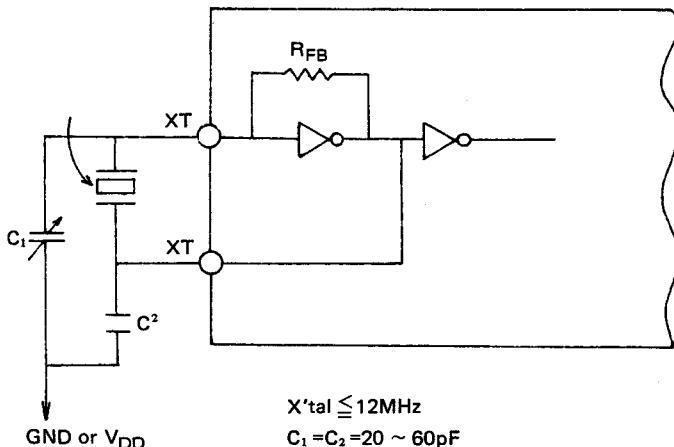
(NOTE)

LD becomes "H" level when FG signal period is within 95.1 to 105% of the reference signal period T in the case of 45 rpm or within 96.3 to 103.7% in the case of 33 1/3 rpm, and becomes "L" level in other regions.



2. Crystal oscillation

Crystal and trimmer capacitor for fine adjustment are combined to terminals XT, \bar{XT} as shown below.



3. CP OUT, CP IN terminals

CP OUT is an output terminal of reference signal (crystal oscillation frequency) divided down by 1/32, and CP IN is a reference signal input terminal. Usually, CP OUT and CP IN are connected with each other.

4. FG IN terminal

This is an input terminal of detection signal (comparison signal), and is operated by capacitor coupling (about 1 μ F).

5. 1/20, 1/27 selection terminal (pull-up resistance built in)

This is a speed selection terminal for reference signal, and can be used to change the rotating speed of the motor. (Refer to Function Table.)

6. ST OUT terminal

This is a reference output terminal for strobe of 1/16 duty, and is suited to one-line application.

7. VS IN, VS OUT terminals

These are reference voltage setting terminals, and are source follower outputs. According to the voltage at VS IN terminal, a voltage within 0 to $V_{DD} - V_{IN}$ may be obtained at VS OUT terminal. ($V_{IN} \approx 2$ V)

8. F/V RC terminal

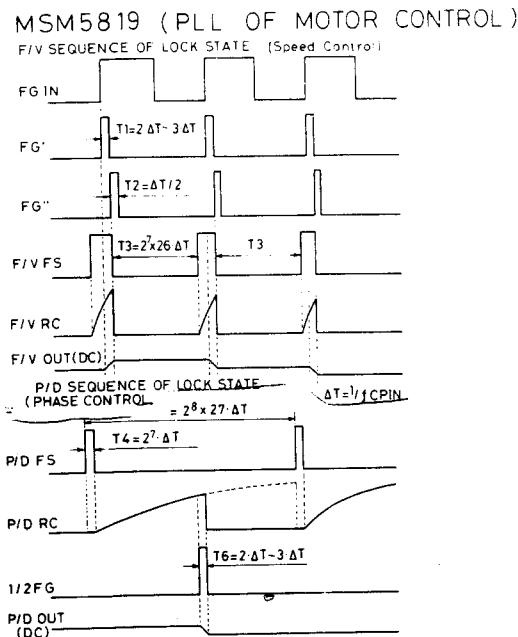
This is an R_1, C_1 connection terminal for generation of sawtooth wave in order to obtain F/V output voltage, and can be used within the range of $C_1 \leq 1 \mu F$, $R_1 \geq 10 k\Omega$. (Refer to an example of applied circuit.)

In designing, the values of C_1 , R_1 are selected on the basis of FG signal period T_{33} at the time of 33-1/3 rpm so that the following relation may be established.

$$T_1 = C_1 \times R_1 \text{ (where, } T_1 = \frac{1}{20} \times T_{33})$$

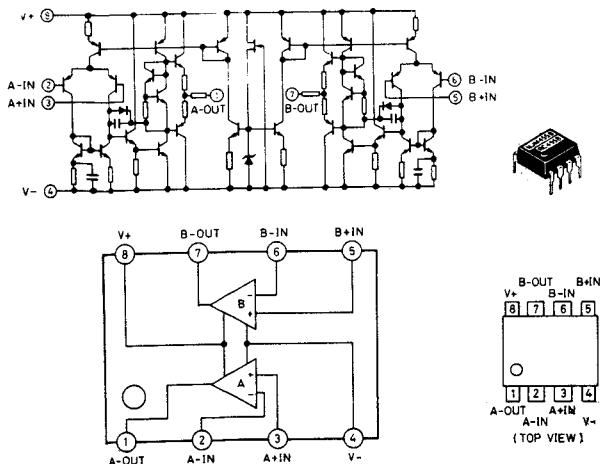
9. F/V HC terminal

This is a holding capacitor connection terminal in order to obtain F/V output voltage, intended to select values so as to satisfy the conditions: $HC \approx 1/10C_1$, $HC \geq 1000$ pF. (Refer to an example of applied circuit.)



MJM 4558

NJM4558 RC4558
(DUAL HIGH-PERFORMANCE OPERATIONAL AMPLIFIERS)



10. P/D RC terminal

This is an R_2, C_2 connection terminal for generation of sawtooth wave in order to obtain P/D output voltage, and can be used within the range of $C_2 \leq 1 \mu F$, $R_2 \geq 10 k\Omega$. (Refer to an example of applied circuit.)

In designing, the values of C_2 , R_2 are selected on the basis of FG signal period T_{33} at the time of 33-1/3 rpm so that the following relation may be established.

$$T_2 = C_2 \times R_2 \text{ (where, } T_2 = \frac{1}{0.7} \times T_{33})$$

11. P/D HC terminal

This is a holding capacitor connection terminal in order to obtain P/D output voltage, intended to select values so as to satisfy the conditions: $HC \approx 1/10C_2$, $HC \geq 1000$ pF.

12. F/V OUT, P/D OUT terminals

These are source follower buffer output terminals of F/V HC and P/P HC terminals, and are capable of obtaining outputs shifted in level by about +2 V with respect to each HC level of F/V and P/D. The source follower resistance is TYP 40 k Ω .

13. LD OUT

This is a lock detection terminal, becoming "H" level (V_{DD}) when the motor speed is around the normal value (within the lock range), and turning to "L" level (GND) if the motor speed is too high or too low (out of the lock range).

FUNCTION TABLE

1/20, 1/27 SELECT TERMINAL	DIVIDING VALUE	r.p.m (REVOLUTIONS PER MINUTE)
L	1/27	33 1/3
H	1/20	45

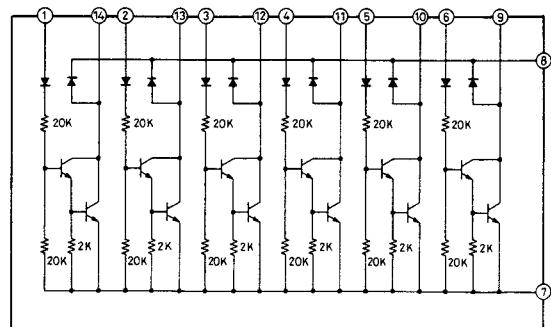
L = GND H = OPEN or V_{DD}

CP IN	1	18	V_{DD}
VS OUT	2	17	X_T
VS IN	3	16	$\bar{X_T}$
FG IN	4	15	CP OUT
F/V RC	5	14	ST OUT
F/V HC	6	13	1/20, 1/27 SELECT
F/V OUT	7	12	P/D RC
LD OUT	8	11	P/D HC
GND	9	10	P/D OUT



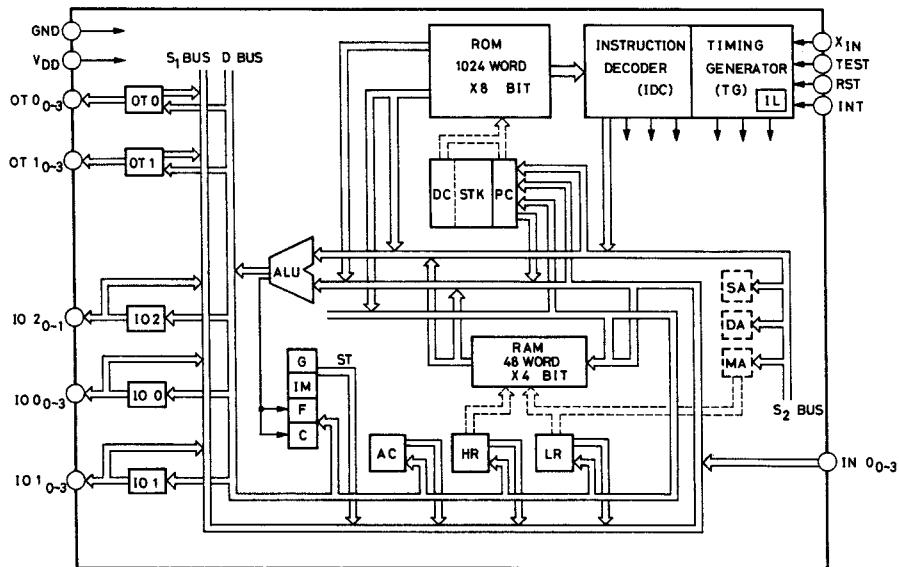
LB 1274

LB1274 (DARLINGTON TRANSISTOR ARRAY)



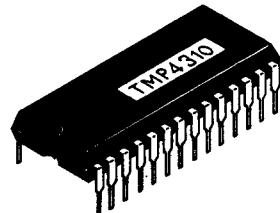
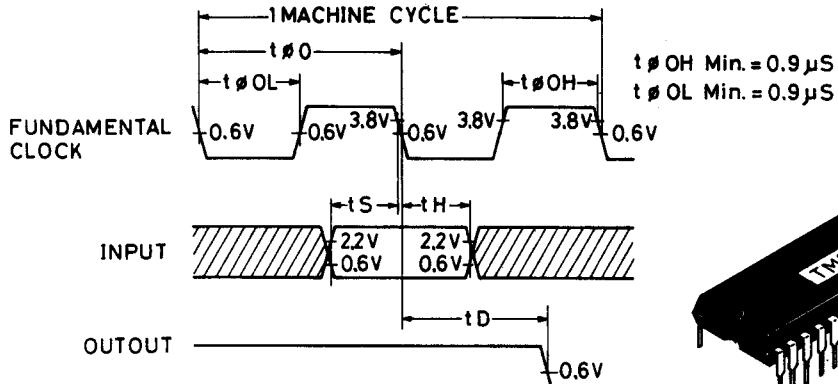
IC BLOCK DIAGRAM TMP4310

TMp4310 (1-CHIP MICRO-COMPUTER <4bit>)
BLOCK DIAGRAM



1/2

TIMING CHART



PIN CONNECTION

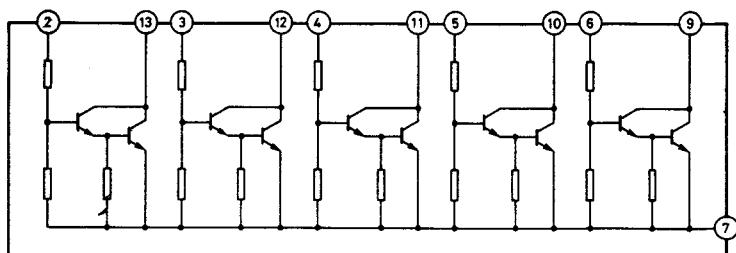
IN 0_0	1	28	VDD
IN 0_1	2	27	XIN
IN 0_2	3	26	TEST
IN 0_3	4	25	IO 10
OT 0_0	5	24	IO 11
OT 0_1	6	23	IO 12
OT 0_2	7	22	IO 13
OT 0_3	8	21	IO 0_0
IO 2_0	9	20	IO 0_1
IO 2_1	10	19	IO 0_2
OT 1_0	11	18	IO 0_3
OT 1_1	12	17	INT
OT 1_2	13	16	RST
GND	14	15	OT 1_3

(TOP VIEW)

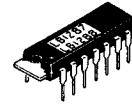
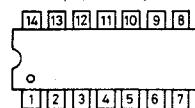
PIN NAME / FUNCTION

NAME	I/O	FUNCTION
IN 0_0 ~ IN 0_3	INPUT	INPUT PORT IN0
OT 0_0 ~ OT 0_3	OUTPUT	OUTPUT PORT OT0
OT 1_0 ~ OT 1_3	OUTPUT	OUTPUT PORT OT1
IO 0_0 ~ IO 0_3	I/O	I/O PORT IO0
IO 1_0 ~ IO 1_3	I/O	I/O PORT IO1
IO 2_0 ~ IO 2_3	I/O	I/O PORT IO2
RST	INPUT	INITIALIZE SIGNAL INPUT
INT	INPUT	INTERRUPT SIGNAL INPUT
XIN	INPUT	FUNDAMENTAL CLOCK TERMINAL
TEST	INPUT	LSI TEST INPUT
VDD		5V (POWER SOURCE)
GND		0V (POWER SOURCE)

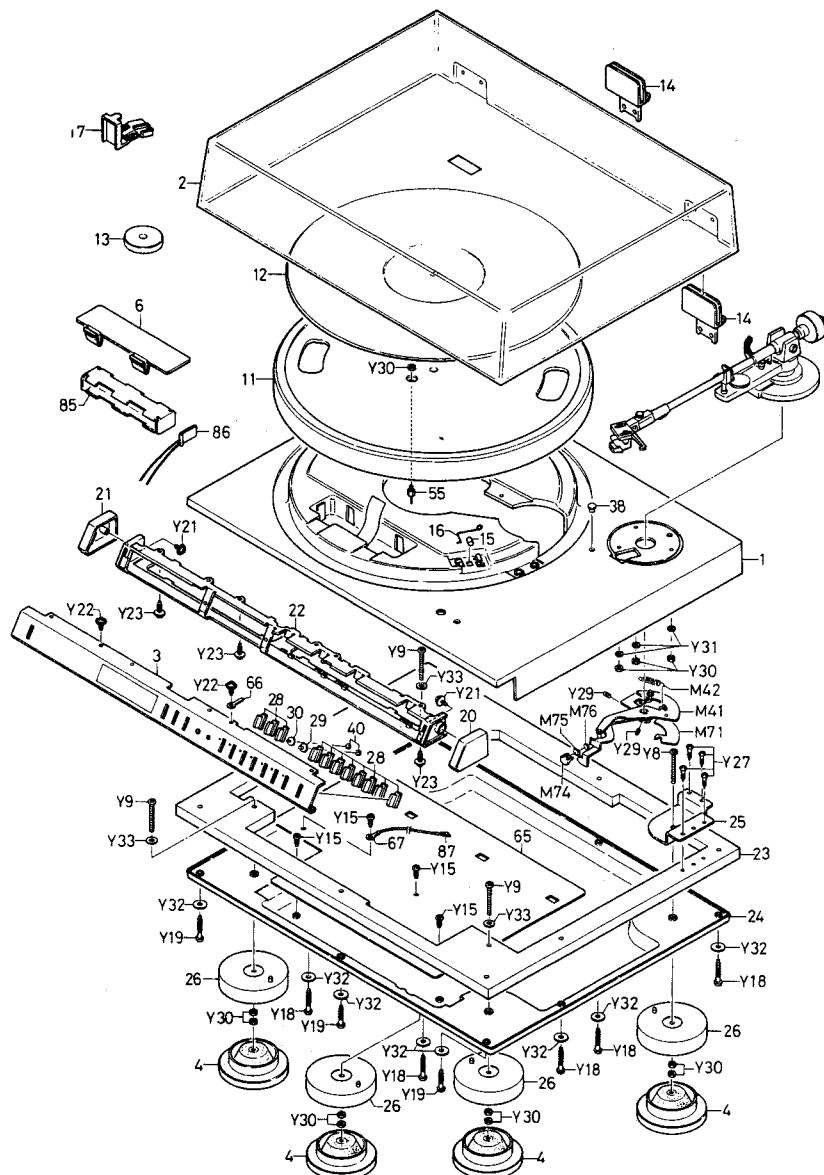
LB1287



(TOP VIEW)



EXPLODED VIEW (CABINET)



Key No.	GENERAL	EUROPE	AUSTRALIA	CANADA	Description	Q'ty
	141-6-133T-14201	141-6-133T-14202	141-6-133T-14203	141-6-133T-14204	Individual Carton	1
	141-6-410T-46401	141-6-410T-46402	141-6-410T-46403	141-6-410T-46404	Instruction Manual	1
	4-236T-11201	—	—	—	Plug Ass'y	1
1	141-0-121T-16401	141-0-121T-16402	141-0-121T-16403	141-0-121T-16404	Deck Panel Ass'y	1
2	141-0-194T-01401	141-0-194T-01401	141-0-194T-01404	141-0-194T-01404	Dust Cover Ass'y	1
8	141-2-445T-16200	141-2-445T-16200	141-2-445T-23900	141-2-445T-16200	Rubber Cushion, AC Cord	1
23	141-2-126T-33100	141-2-126T-33101	141-2-126T-33100	141-2-126T-33100	Back Lid	1
27	141-2-852T-60601	141-2-852T-59700	141-2-852T-60601	141-2-852T-60601	Spring Wire	1
69	141-2-472T-01201	141-2-472T-01200	141-2-464T-20671	141-2-472T-01201	Fixer	5
70	—	141-6-476T-14700	—	—	Indication Label, Fuse	1
71	—	141-2-411T-12200	—	—	Plate Nut	1
72	—	141-2-327T-22300	—	—	Insulator	1
73	—	141-2-322T-64500	—	—	Shield Plate	1
74	—	141-2-250T-02500	—	—	Sheet	1
81	4-300T-20100	4-300T-19900	4-300T-25700	4-300T-22300	Power Trans (TP1)	1
82	4-300T-20200	4-300T-20000	4-300T-25800	4-300T-22400	Power Trans (TP2)	1
83	4-243R-00194	4-243T-77172	4-243T-84200	4-243T-81271	Power Cord	1
88	4-238T-01371	4-238T-12873	4-238T-01373	4-238T-01371	Power Switch (S811)	1
89	—	141-2-383T-03900	141-2-383T-03900	—	Fuse Holder	1
90	—	4-234T-01971	4-234T-01971	—	Fuse 800mA	1
91	4-231T-37603	4-231T-53677	—	—	Switch (S812)	1
103	141-4-233T-40702	141-4-233T-40701	141-4-233T-40701	141-4-233T-40703	P.C. Board Ass'y, Power Supply	1
C934	4-223T-05400	4-223T-11700 (0.01μF)	4-223T-11700 (0.01μF)	4-223T-10700 (0.047μF)	Capacitor	1
R910 911	—	100 ohm 1/2W	100 ohm 1/2W	—	Resistor	2
A6	141-2-421T-30900	141-2-421T-30902	141-2-421T-30900	141-2-421T-30900	Special Screw	2
A10	4-157T-00801	4-157T-01201	4-157T-00801	—	Cartridge Ass'y	1

PARTS LIST.

PARTS LIST

Key No.	Part No.	Description	Q'ty	Key No.	Part No.	Description	Q'ty
ELECTRICAL PARTS				PITCH CONTROL PCB ASS'Y			
81	See Page 8	Power Trans. (PT1)	1	R220		Carbon 1M ohm	$\pm 5\%$ 1/4W
82	See Page 8	Power Trans. (PT2)	1	R221		Carbon 1M ohm	$\pm 5\%$ 1/4W
83	See Page 8	Power Cord	1	R222		Carbon 1M ohm	$\pm 5\%$ 1/4W
84	4-243T-15171	Cord	1	R223		Carbon 1M ohm	$\pm 5\%$ 1/4W
85	141-2-331T-04300	Holder, Battery	1	R224		Carbon 1M ohm	$\pm 5\%$ 1/4W
86	4-243T-18800	Cord, Battery	1	R225		Carbon 1M ohm	$\pm 5\%$ 1/4W
87	4-235T-34600	Socket	6	R207		Metal 910K ohm	$\pm 1\%$ 1/4W
88	See Page 8	Power Switch (S811)	1	R301		Carbon 180K ohm	$\pm 5\%$ 1/4W
89	See Page 8	Fuse Holder	1	R302		Carbon 100K ohm	$\pm 5\%$ 1/4W
90	See Page 8	Fuse 800mA	1	R303		Carbon 100K ohm	$\pm 5\%$ 1/4W
91	See Page 8	Switch S812	1	R304		Carbon 100K ohm	$\pm 5\%$ 1/4W
111	4-230T-82100	P.C. Board, Output cord	1	R305		Carbon 180K ohm	$\pm 5\%$ 1/4W
				R306		Carbon 100K ohm	$\pm 5\%$ 1/4W
				R307		Carbon 1M ohm	$\pm 5\%$ 1/4W
				R308		Carbon 1M ohm	$\pm 5\%$ 1/4W
				R309		Carbon 15K ohm	$\pm 5\%$ 1/4W
				R310		Carbon 15K ohm	$\pm 5\%$ 1/4W
				R311		Carbon 10K ohm	$\pm 5\%$ 1/4W
				R312		Carbon 10K ohm	$\pm 5\%$ 1/4W
				R313		Carbon 1M ohm	$\pm 5\%$ 1/4W
				R314		Carbon 180K ohm	$\pm 5\%$ 1/4W
				R315		Carbon 2.7M ohm	$\pm 5\%$ 1/4W
				R316		Carbon 56K ohm	$\pm 5\%$ 1/4W
				R317		Carbon 10K ohm	$\pm 5\%$ 1/4W
				R318		Carbon 100K ohm	$\pm 5\%$ 1/4W
				R319		Carbon 10K ohm	$\pm 5\%$ 1/4W
				R401		Carbon 100K ohm	$\pm 5\%$ 1/4W
				R402		Carbon 56K ohm	$\pm 5\%$ 1/4W
				R403		Carbon 10K ohm	$\pm 5\%$ 1/4W
				R404		Carbon 100K ohm	$\pm 5\%$ 1/4W
				R405		Carbon 56K ohm	$\pm 5\%$ 1/4W
				R406		Carbon 10K ohm	$\pm 5\%$ 1/4W
				R407		Carbon 2.7M ohm	$\pm 5\%$ 1/4W
				R408		Carbon 15K ohm	$\pm 5\%$ 1/4W
				R409		Carbon 150 ohm	$\pm 5\%$ 1/4W
				R410		Carbon 39K ohm	$\pm 5\%$ 1/4W
				R411,412, 414,416, 418,421		Carbon 22K ohm	$\pm 5\%$ 1/4W
				R422,424, 426,428		Metal 30K ohm	$\pm 5\%$ 1/4W
				R413,415, 410,423, 425,427		Metal 30K ohm	$\pm 1\%$ 1/4W
				R419		Metal 15K ohm	$\pm 1\%$ 1/4W
				R420		Metal 91K ohm	$\pm 1\%$ 1/4W
				R429		Metal 560K ohm	$\pm 1\%$ 1/4W
				R501		Metal 910K ohm	$\pm 1\%$ 1/4W
				R502		Carbon 1M ohm	$\pm 5\%$ 1/4W
				R503		Carbon 220K ohm	$\pm 5\%$ 1/4W
				R504		Carbon 680K ohm	$\pm 5\%$ 1/4W
				R701,703, 705,706, 707,708		Carbon 330K ohm	$\pm 5\%$ 1/4W
				R702,704		Carbon 4.7K ohm	$\pm 5\%$ 1/4W
				R710		Carbon 4.7K ohm	$\pm 5\%$ 1/4W
				R711		Carbon 120K ohm	$\pm 5\%$ 1/4W
				R712		Carbon 6.8K ohm	$\pm 5\%$ 1/4W
				R713,715		Carbon 12K ohm	$\pm 5\%$ 1/4W
				R714,716		Carbon 120K ohm	$\pm 5\%$ 1/4W
				R717,718, 719,720		Carbon 120K ohm	$\pm 5\%$ 1/4W
				R721,758		Carbon 120K ohm	$\pm 5\%$ 1/4W
				R722		Carbon 4.7K ohm	$\pm 5\%$ 1/4W
				R723		Carbon 27K ohm	$\pm 5\%$ 1/4W
				R724		Carbon 4.7K ohm	$\pm 5\%$ 1/4W
				R725,726		Carbon 120K ohm	$\pm 5\%$ 1/4W
				R727		Carbon 12K ohm	$\pm 5\%$ 1/4W
				R728		Carbon 4.7K ohm	$\pm 5\%$ 1/4W
				R729		Carbon 1.5K ohm	$\pm 5\%$ 1/4W
				R730,732, 734,736		Carbon 4.7K ohm	$\pm 5\%$ 1/4W
				R731,733, 735		Carbon 4.7K ohm	$\pm 5\%$ 1/4W
				R737,738 742,751		Carbon 4.7K ohm	$\pm 5\%$ 1/4W
				R756		Carbon 56K ohm	$\pm 5\%$ 1/4W
				R757		Carbon 5.6K ohm	$\pm 5\%$ 1/4W
				R759		Carbon 8.2K ohm	$\pm 5\%$ 1/4W
				R739		Carbon 27K ohm	$\pm 5\%$ 1/4W
R201		Carbon 100K ohm	$\pm 5\%$ 1/4W				
R202		Carbon 100K ohm	$\pm 5\%$ 1/4W				
R203		Carbon 47K ohm	$\pm 5\%$ 1/4W				
R204		Carbon 68K ohm	$\pm 5\%$ 1/4W				
R205		Carbon 100K ohm	$\pm 5\%$ 1/4W				
R206		Carbon 2.7M ohm	$\pm 5\%$ 1/4W				
R208		Carbon 10K ohm	$\pm 5\%$ 1/4W				
R209		Carbon 100K ohm	$\pm 5\%$ 1/4W				
R210		Carbon 100K ohm	$\pm 5\%$ 1/4W				
R211		Carbon 2.7M ohm	$\pm 5\%$ 1/4W				
R212		Carbon 180K ohm	$\pm 5\%$ 1/4W				
R213		Carbon 1M ohm	$\pm 5\%$ 1/4W				
R214		Carbon 1M ohm	$\pm 5\%$ 1/4W				
R215		Carbon 1M ohm	$\pm 5\%$ 1/4W				
R216		Carbon 1M ohm	$\pm 5\%$ 1/4W				
R217		Carbon 1M ohm	$\pm 5\%$ 1/4W				
R218		Carbon 1M ohm	$\pm 5\%$ 1/4W				
R219		Carbon 1M ohm	$\pm 5\%$ 1/4W				

PARTS LIST

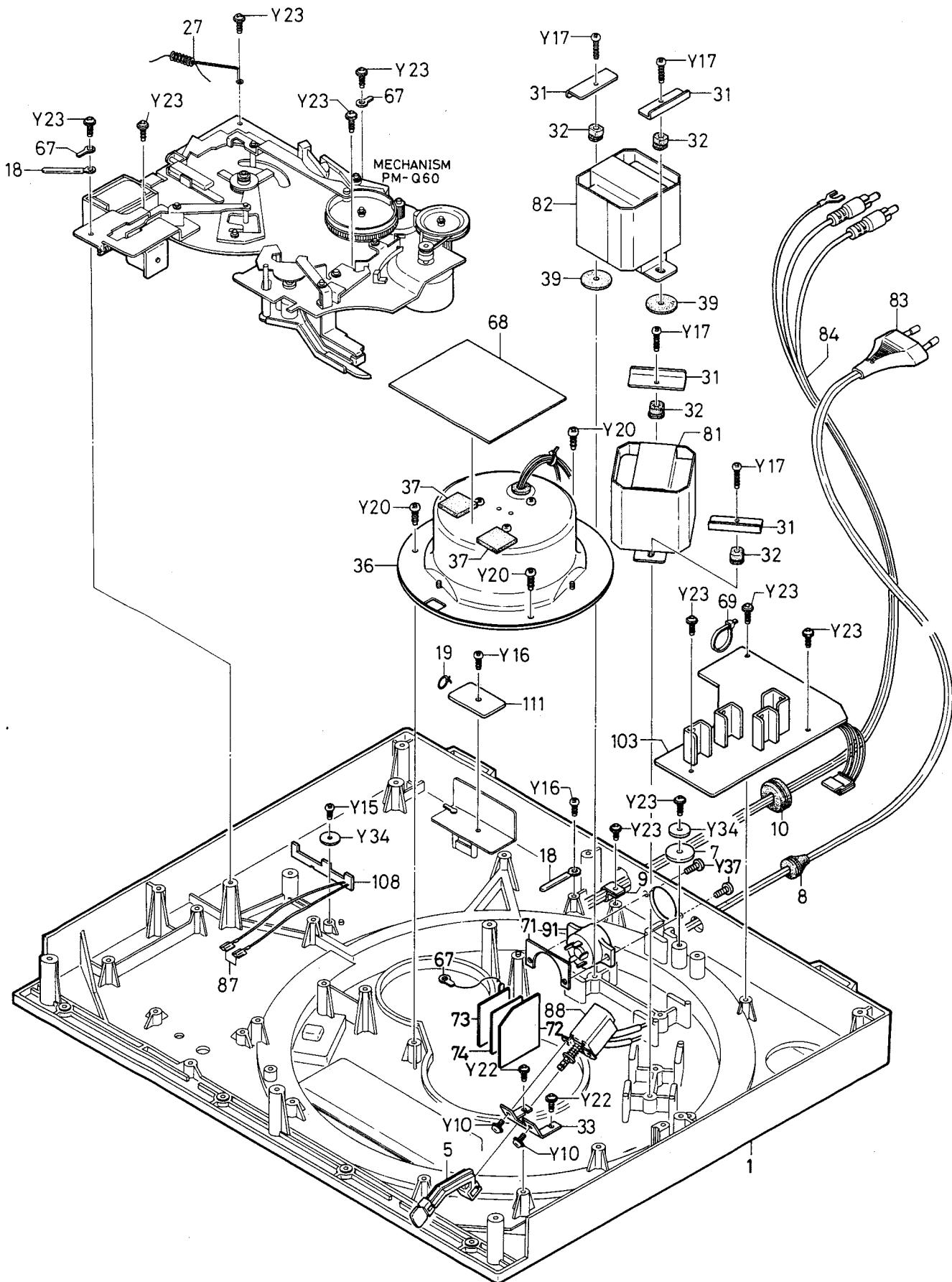
Key No.	Part No.	Description	Q'ty	Key No.	Part No.	Description	Q'ty
PITCH CONTROL PCB ASS'Y				CONTROL PCB ASS'Y			
R740		Carbon 56K ohm	±5% 1/4W	1	810,811		
R741		Carbon 22K ohm	±5% 1/4W	1	815,816		
R743		Carbon 2.7K ohm	±5% 1/4W	1	D805,812		
R744		Carbon 3.3K ohm	±5% 1/4W	1	813		
R745		Carbon 4.7K ohm	±5% 1/4W	1	D814		
R747		Carbon 27K ohm	±5% 1/4W	1	Q801,803		
R748		Carbon 39K ohm	±5% 1/4W	1	Q804		
R749		Carbon 10K ohm	±5% 1/4W	1	Q802		
R750		Carbon 15K ohm	±5% 1/4W	1	Q805,806		
R752		Carbon 2.7K ohm	±5% 1/4W	1	807,808		
R755		Carbon 150 ohm	±5% 1/4W	1			
R746		Carbon 22K ohm	±5% 1/4W	1			
R754		Metal 68 ohm	±5% 1W	1			
CAPACITORS				RESISTORS			
C201		PP Con 0.1μF 100V	±5%	1	R831,832	FP-Carbon 10 ohm	±5% 1/4W
C202		Mylar 0.0022μF 50V	±20%	1	R820	Metal 68 ohm	±5% 2W
C203		Al Electrolytic 2.2μF 50V	+40 -20%	1	R819,826	Carbon 820 ohm	±10% 1/4W
C204,209		Electrolytic 220μF 10V		2	827,828		
C208		Electrolytic 10μF 10V		1	838		
C205,206		Ceramic 0.01μF 50V +80 -20%		4	R815	Carbon 2.2K ohm	±10% 1/4W
207,211					R816,817	Carbon 3.3K ohm	±10% 1/4W
C210		Ceramic 0.001μF 50V ±10%		1	R809,810	Carbon 5.6K ohm	±10% 1/4W
C301,302		Mylar 0.047μF 50V ±20%		2	R802,804	Carbon 10K ohm	±10% 1/4W
C303		Mylar 0.033μF 50V ±20%		1	805,807		
C304		Al Electrolytic 1μF 10V +40 -20%		1	808,812		
C305,306		Ceramic 47pF 50V ±20%		2	R813,822	Carbon 10K ohm	±10% 1/4W
C307,310		Ceramic 0.01μF 50V +80 -20%		5	823,824		
311,314,					825,834		
315					R835,818	Carbon 10K ohm	±10% 1/4W
C317		Ceramic 0.001μF 50V ±10%		1	R803	Carbon 22K ohm	±10% 1/4W
C312,313		Ceramic 470pF 50V ±10%		2	R829,830	Carbon 47K ohm	±10% 1/4W
C308,316		Ceramic 220pF 50V ±10%		2	R821,837	Carbon 100K ohm	±10% 1/4W
C309		Ceramic 0.0033μF 50V ±10%		1	R836	Carbon 1M ohm	±10% 1/4W
C402,407		Electrolytic 100μF 10V		2	R801,811	Carbon 1.5M ohm	±10% 1/4W
C403		Electrolytic 10μF 10V		1	814,833		
C405		Electrolytic 220μF 10V		1	R806	Carbon 2.2M ohm	±10% 1/4W
C408		Electrolytic 330μF 10V		1	R839,840	Carbon 100K ohm	±10% 1/4W
C404		Mylar 0.022μF 50V ±10%		1	841,842		
C406,409		Ceramic 0.01μF 50V +80 -20%		3			
410							
C501 ~							
504							
C701		Ceramic 0.01μF 50V +80 -20%		4			
C702		Al Electrolytic 0.47μF 10V	+40 -20%	1			
C703,705,		Ceramic 100pF 50V ±10%		1	C803,825	Electrolytic 1μF 50V	
709		Mylar 0.001μF 10V ±20%		3	C809	Electrolytic 4.7μF 25V	
C708					C808	Electrolytic 10μF 16V	
C707		Mylar 0.1μF 50V ±20%		1	C823	Electrolytic 100μF 10V	
C711		Ceramic 470pF 50V ±10%		1	C802,805	Mylar 0.01μF 50V ±20%	
C712		Electrolytic 330μF 6.3V		1	819	Ceramic 0.001μF 50V ±10%	
C713,714		Electrolytic 470μF 6.3V		1	C807,810		
715,716		Ceramic 0.01μF 50V +80 -20%		5	811,832,		
717					833		
C718,719		Ceramic 0.01μF 50V +80 -20%		2	C801,804	Ceramic 0.01μF 50V +80 -20%	
C704,720		Ceramic 0.022μF 50V +80 -20%		2	806,813		
C721		Electrolytic 10μF 10V		1	814,815		
CONTROL PCB ASS'Y				CAPACITORS			
102	141-4-233T-40900	P.C. Board Assy, Control		1	C816,817	Electrolytic 1μF 50V	
RAI	4-221T-02900	Resistor		1	818,821	Electrolytic 4.7μF 25V	
	4-235T-90700	Socket		1	822,824	Electrolytic 10μF 16V	
	4-235T-69471	Socket		1	831,820	Electrolytic 100μF 10V	
	4-236T-10271	Plug		1	834	Mylar 0.01μF 50V ±20%	
IC801,802	IC TC4001BP			1	C812	Ceramic 0.047μF 50V +80 -20%	
804							
IC807	IC TC4011BP						
IC806	IC TC4013BP						
IC805	IC TC4043BP						
IC803	IC TC4071BP						
IC808	IC LB1287 DIP14						
D801,802	Diode DS442 X						
803,804							
806,807							
808,809							
POWER SUPPLY PCB ASSY				P.C. Board Assy, Power Supply			
103		See Page 8		1	Transistor 2SD330		
Q901,902				4			
903,904							
Q905					Transistor 2SD400		
Q906					Transistor 2SD545		
Q907					Transistor 2SB598		
D908,909					Diode W02		
910,911							
912							
D905					Zener Diode WZ056		
D906,907					Zener Diode WZ096		
D903					Zener Diode WZ100		
D902					Zener Diode WZ192		
D901					Zener Diode XZ215		
D904					Diode 1S2473		
					Pan Head Tapping Screw, 3 x 8		
141-2-368T-18700					4		
4-235T-90400					Heat Sink (Q901 ~ Q904)		
					Socket		
							1

PARTS LIST

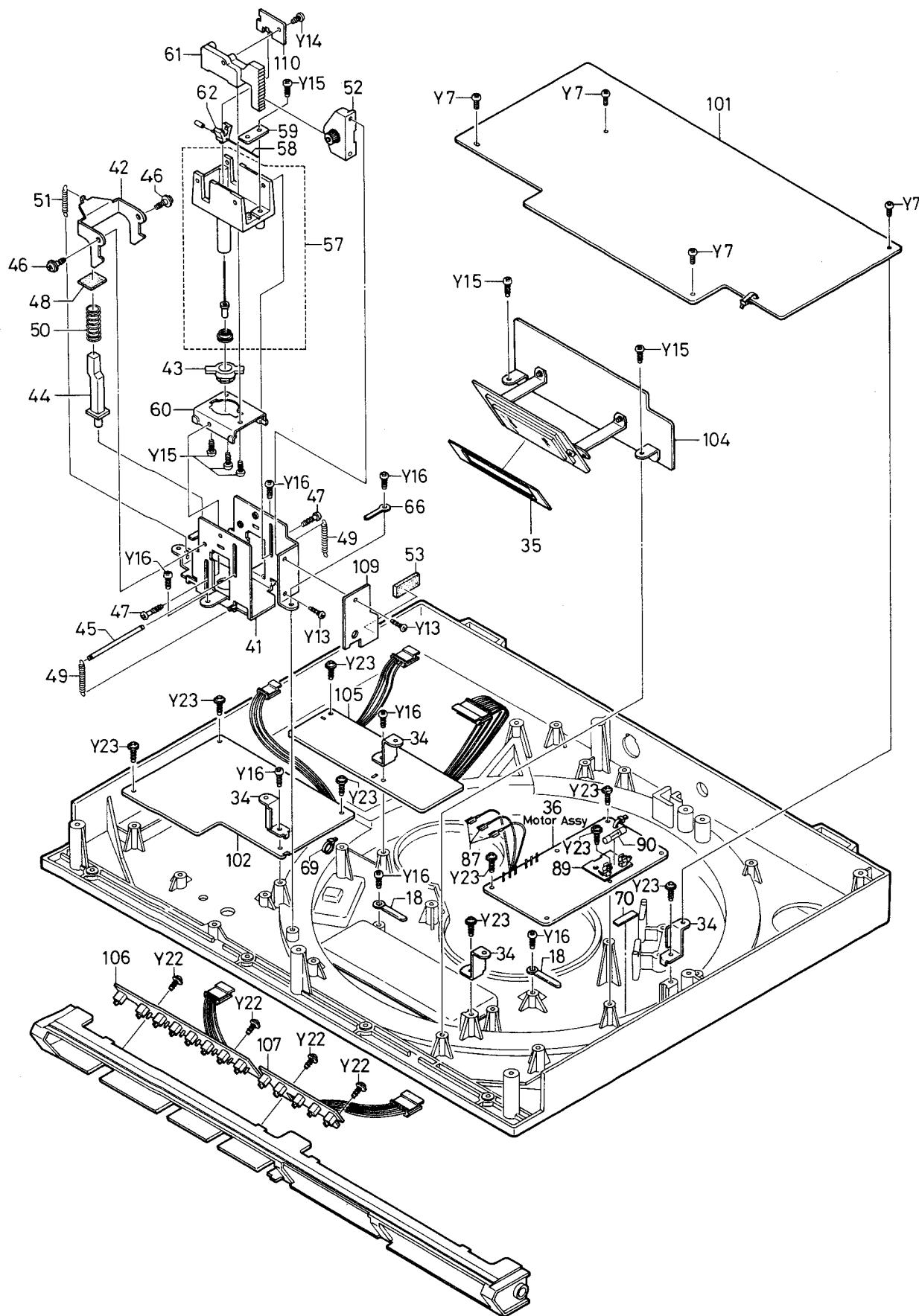
Key No.	Part No.	Description	Q'ty
POWER SUPPLY PCB ASS'Y			
R910,911		RESISTORS	
R904		See Page 8	
R903		Solid 330 ohm $\pm 10\%$ 1/2W	1
R902		Solid 820 ohm $\pm 10\%$ 1/2W	1
R901		Solid 1.2K ohm $\pm 10\%$ 1/2W	1
R905		Solid 1.5K ohm $\pm 10\%$ 1/2W	1
R906		Metal 68 ohms $\pm 5\%$ 2W	1
R908,909		Carbon 680 ohm $\pm 10\%$ 1/4W	1
R907		Carbon 220 ohm $\pm 10\%$ 1/4W	2
		Carbon 470 ohm $\pm 10\%$ 1/4W	1
C913		CAPACITORS	
C905		Electrolytic 2200 μ F 16V	1
C919,924		Electrolytic 1000 μ F 35V	1
C907		Electrolytic 470 μ F 16V	2
C901		Electrolytic 330 μ F 25V	1
C909		Electrolytic 220 μ F 35V	1
C914,920		Electrolytic 220 μ F 25V	1
C903		Electrolytic 100 μ F 25V	2
C911		Electrolytic 100 μ F 16V	1
C917		Electrolytic 470 μ F 6.3V	1
C926		Electrolytic 33 μ F 16V	1
C902,906		Electrolytic 10 μ F 25V	2
C910,916		Electrolytic 10 μ F 16V	4
921,925		Ceramic 0.01 μ F 50V +80 -20%	12
908,912		See Page 8	
915,918			
923,927			
929,930			
931,932			
933,904			
C934			
DISPLAY PCB ASS'Y			
104	141-4-233T-40800	P.C. Board Ass'y, Display	1
IC601,602		IC TC4511BP DIP16	3
603			
IC604			
Q601,602	141-2-377T-26300	IC LB1274	1
603	141-2-377T-26200	LED SL271202 Green	1
	141-2-377T-26201	Transistor 2SC536 AUD.	3
		Bracket P.C. Board	2
		Bracket P.C. Board	1
		Bracket P.C. Board	1
		Pan Head Screw 3 x 6	6
R601,602		RESISTORS	
606,607		Carbon 470 ohm $\pm 10\%$ 1/4W	6
626,630		Carbon 470 ohm $\pm 10\%$ 1/4W	6
R603,604		Carbon 470 ohm $\pm 10\%$ 1/4W	6
605,608		Carbon 470 ohm $\pm 10\%$ 1/4W	6
609,610		Carbon 470 ohm $\pm 10\%$ 1/4W	6
R611,612		Carbon 470 ohm $\pm 10\%$ 1/4W	5
613,614		Carbon 470 ohm $\pm 10\%$ 1/4W	5
615,616		Carbon 150 ohm $\pm 10\%$ 1/4W	3
R617,618		Carbon 220 ohm $\pm 10\%$ 1/4W	1
619,620		Carbon 330 ohm $\pm 10\%$ 1/4W	1
621		Carbon 330 ohm $\pm 10\%$ 1/4W	2
R622,623		Carbon 10K ohm $\pm 10\%$ 1/4W	1
624		Carbon 33K ohm $\pm 10\%$ 1/4W	1
R625		Carbon 15K ohm $\pm 10\%$ 1/4W	1
R627		CAPACITORS	
R628,629		Ceramic 0.01 μ F 50V +80 -20%	3
R631		Ceramic 470pF 50V $\pm 10\%$	1
R632			
R633			
C601,602			
603			
C604			

Key No.	Part No.	Description	Q'ty
SENSOR AMP. PCB ASS'Y			
105	141-4-233T-40500	P.C. Board Ass'y, Sensor	1
IC103		IC TL072CP DIP08 } or	1
TC101,102		IC TL082CP DIP08 } or	1
Q101		IC RC4558P	2
D101		Transistor 2SA608	1
D102		Diode 1S1885	1
RL101	4-232T-05500	Diode 1S2473	1
	4-235T-90200	Relay	1
	4-235T-90500	Socket	1
VR102	4-222T-82977	Socket	1
VR101	4-222T-39576	Semifixed Variable Resistor	1
		Semifixed Variable Resistor	1
RESISTORS			
R103		Carbon 220 ohm $\pm 5\%$ 1/4W	1
R102		Carbon 1K ohm $\pm 5\%$ 1/4W	1
R121		Carbon 1.2K ohm $\pm 5\%$ 1/4W	1
R720		Carbon 5.6K ohm $\pm 5\%$ 1/4W	1
R101		Carbon 2.2K ohm $\pm 5\%$ 1/4W	1
R107,108		Carbon 6.8K ohm $\pm 5\%$ 1/4W	2
R119		Carbon 10K ohm $\pm 5\%$ 1/4W	1
R109		Carbon 5.6K ohm $\pm 5\%$ 1/4W	1
R113,116		Carbon 56K ohm $\pm 5\%$ 1/4W	4
117,122			
R104,105		Carbon 100K ohm $\pm 5\%$ 1/4W	2
R118		Carbon 180K ohm $\pm 5\%$ 1/4W	1
R106,112		Carbon 560K ohm $\pm 5\%$ 1/4W	2
R123		Carbon 1M ohm $\pm 5\%$ 1/4W	1
R111		Carbon 1.5M ohm $\pm 5\%$ 1/4W	1
R115		Carbon 2.2M ohm $\pm 5\%$ 1/4W	1
R110		Carbon 12K ohm $\pm 5\%$ 1/4W	1
R124		Carbon 27K ohm $\pm 5\%$ 1/4W	1
R126		Carbon 68K ohm $\pm 5\%$ 1/4W	1
R114		Metal 5.1K ohm $\pm 1\%$ 1/4W	1
CAPACITORS			
C101		Mylar 0.022 μ F 25V $\pm 20\%$	1
C102		Mylar 0.01 μ F 25V $\pm 20\%$	1
C103,104		Tantal 47 μ F 6.3V $\pm 20\%$	2
C105,106		Ceramic 0.01 μ F 50V +80 -20%	4
108,109		Electrolytic 1 μ F 50V	1
C110			
SWITCH-1 PCB ASS'Y			
106	141-4-233T-41000	P.C. Board Ass'y, Switch-1	1
S851 ~ 858	4-238T-08800	Switch	8
D851 ~ 857		LED SLP135B A or B Red	7
R851	4-235T-90600	Socket	1
		Carbon Res. 820 ohm $\pm 10\%$ 1/2W	1
SWITCH-2 PCB ASS'Y			
107	141-4-233T-41100	P.C. Board Ass'y, Switch-2	1
S821 ~ 825	4-238T-08800	Switch	5
	4-235T-90300	Socket	1
LEAD SWITCH PCB ASS'Y			
108	141-4-233T-41200	P.C. Board Ass'y, Lead Switch	1
S401	4-231T-70300	Lead Switch	1
	4-235T-34600	Socket	2
SENSOR RELAY PCB ASS'Y			
109	141-4-233T-60900	P.C. Board Ass'y, Sensor Relay	1
	4-236T-10571	Plug	1
SENSOR PCB ASS'Y			
110	141-4-233T-42100	P.C. Board Ass'y, Sensor Magnet Sensor F1410F	1
			1

EXPLODED VIEW (CHASSIS)



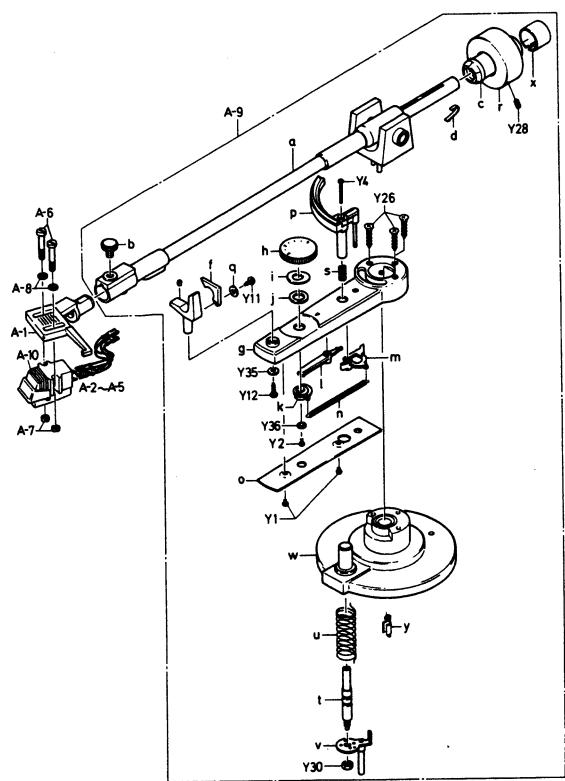
EXPLODED VIEW (CHASSIS)



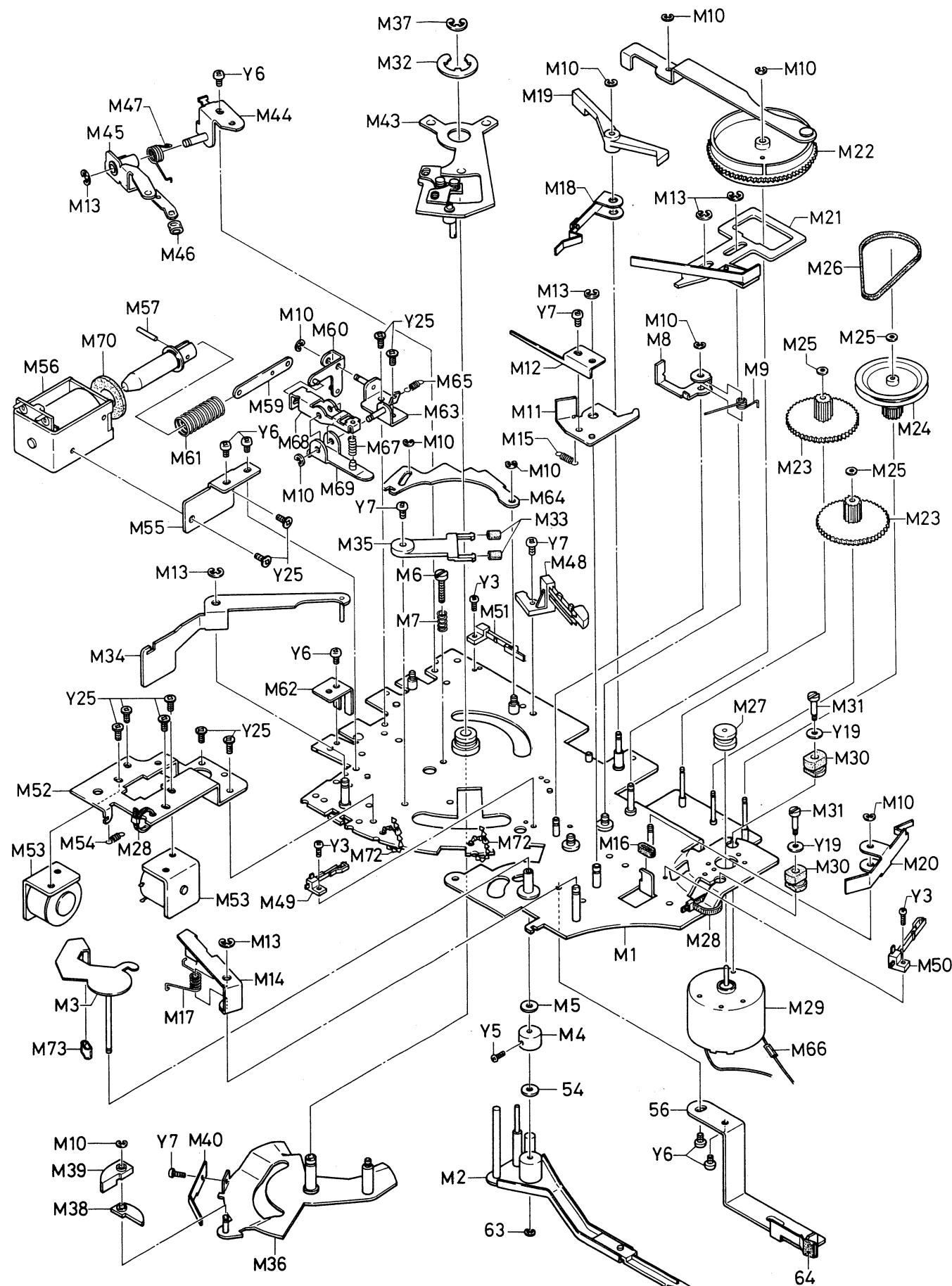
PARTS LIST

Key No.	Part No.	Description	Q'ty
ARM			
A1	141-0-286T-01100	Head Shell Ass'y	1
A2	4-243T-18100	Lead Cord (White)	1
A3	4-243T-18171	Lead Cord (Blue)	1
A4	4-243T-18172	Lead Cord (Red)	1
A5	4-243T-18173	Lead Cord (Green)	1
A6	See Page 8	Special Screw	2
A7	141-2-417T-19900	Stud Nut	2
A8	141-2-453T-32200	Washer	2
A9	141-0-743T-06922	Arm Complete	1
a	141-0-743T-06901	-Arm Ass'y	1
b	141-2-155T-05700	-Ring Knob	1
c	141-0-687T-02001	-Weight Ass'y	1
d	141-0-853T-65700	-Spring Plate Ass'y	1
e	141-2-873T-00600	-Rest	1
f	141-2-873T-00700	-Rest	1
g	141-2-243T-11000	Base	1
h	141-2-155T-05800	-Ring Knob	1
i	141-2-457T-14600	-Special Washer	1
j	141-2-453T-20800	-Washer 6.2 x 10 x 0.5	1
k	141-2-661T-30400	Pulley	1
l	141-2-742T-45100	Lever	1
m	141-2-742T-45200	Lever	1
n	141-2-855T-48501	Spring Coil	1
o	141-2-135T-64000	Cover	1
p	141-0-872T-00520	Lifter Ass'y	1
q	141-2-453T-32300	Washer	1
r	141-2-687T-02100	-Weight	1
s	141-2-855T-48600	Spring Coil	1
t	141-0-753T-92800	Shaft Ass'y	1
u	141-2-855T-48700	Spring Coil	1
v	141-0-742T-45300	Lever Ass'y	1
w	141-0-174T-09120	Stand Ass'y	1
x	141-2-352T-39600	Spacer	1
y	141-2-472T-09300	Lug	1
A10	See Page 8	Cartridge Assy	1

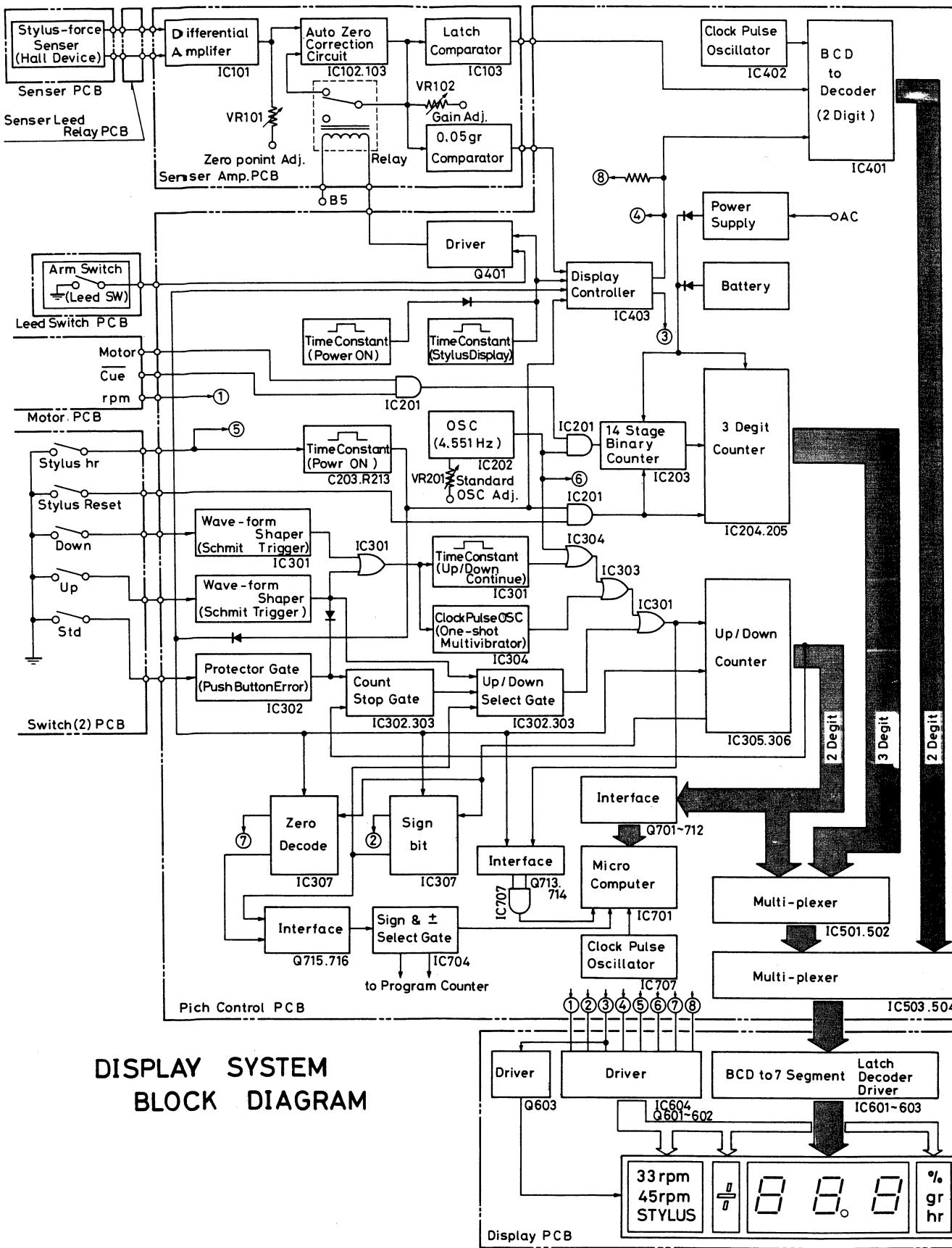
EXPLODED VIEW (ARM)



EXPLODED VIEW (MECHANISM)

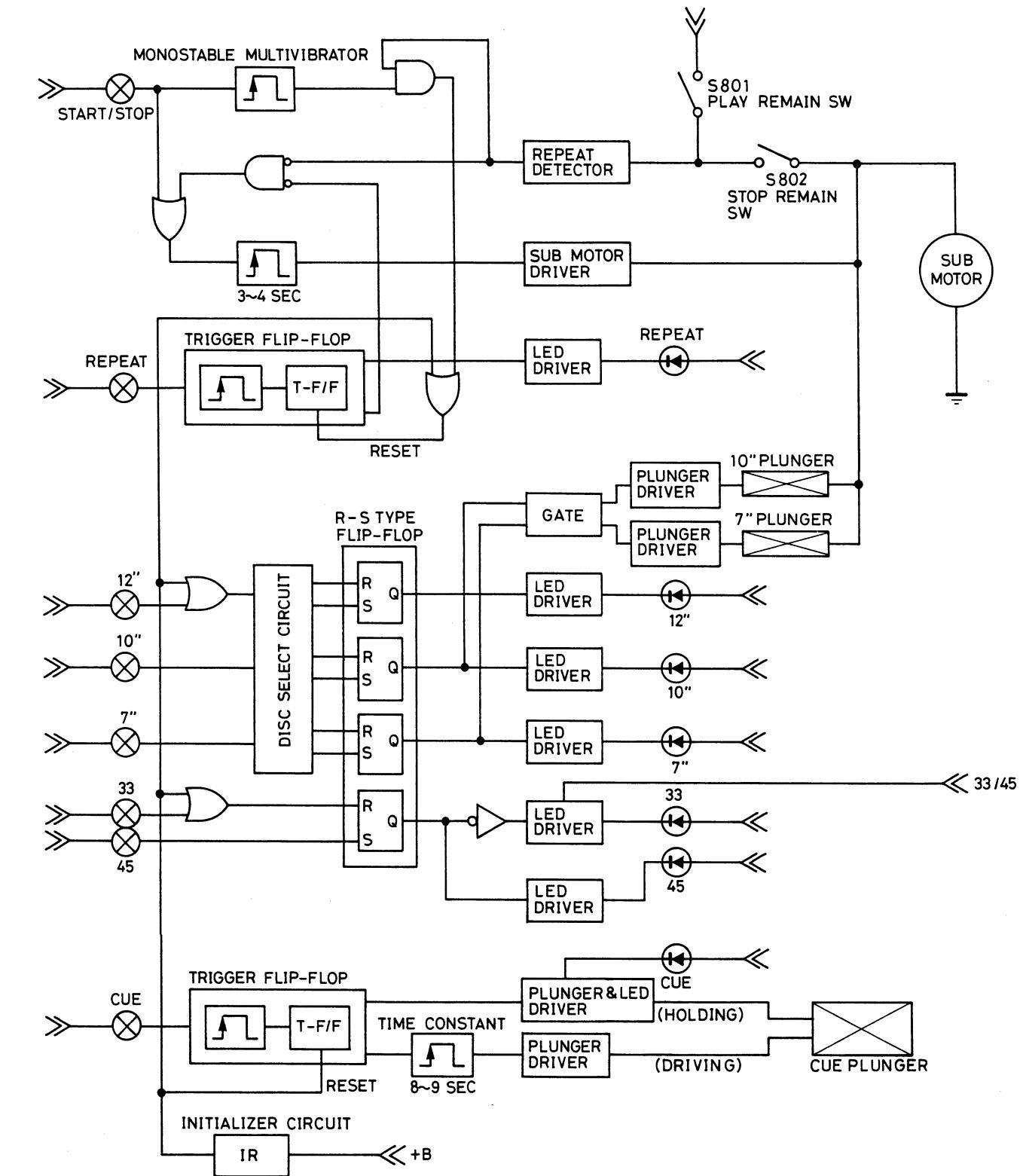


DISPLAY SYSTEM BLOCK DIAGRAM



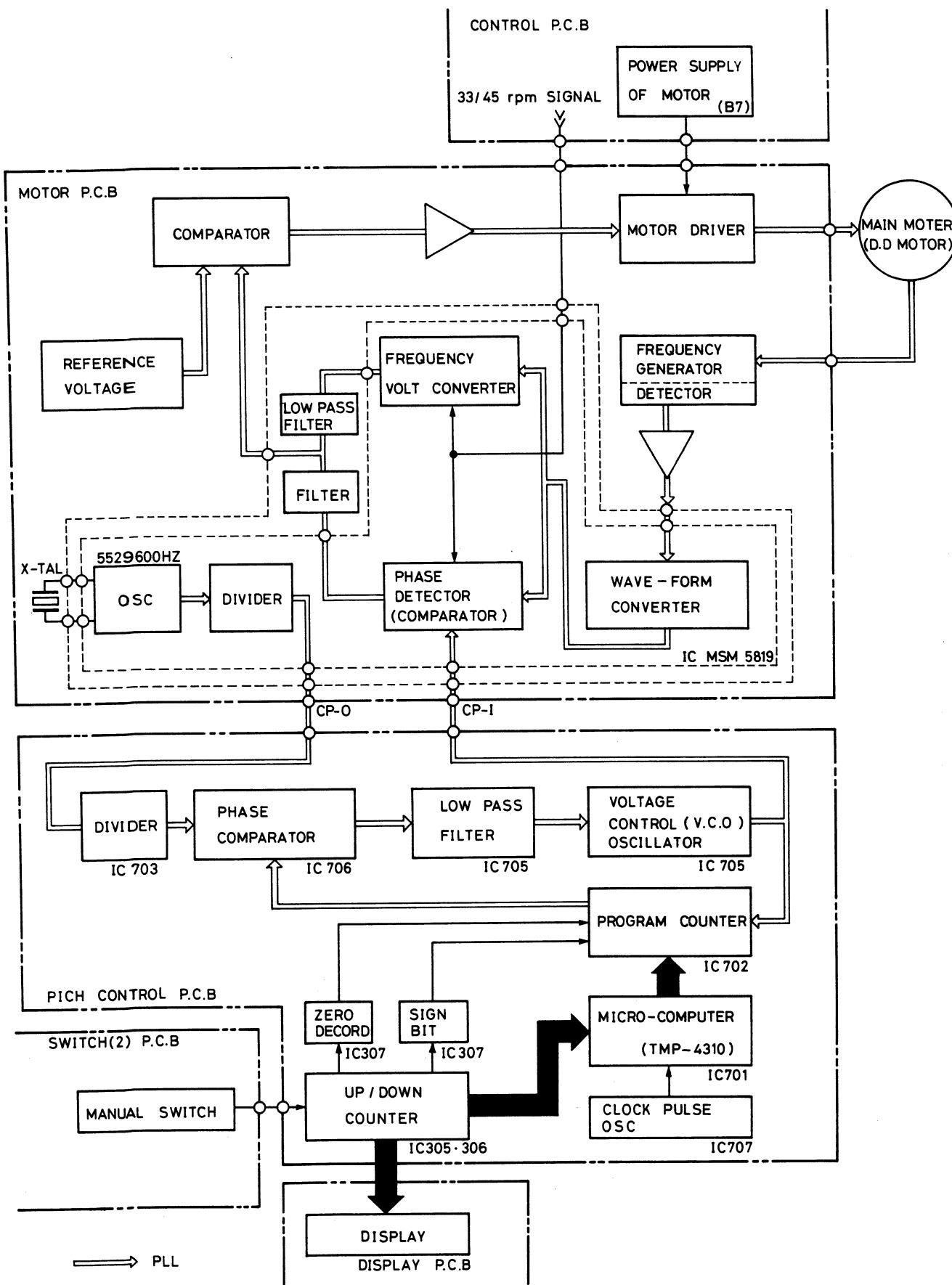
BLOCK DIAGRAM

MECHANISM CONTROL CIRCUIT



BLOCK DIAGRAM

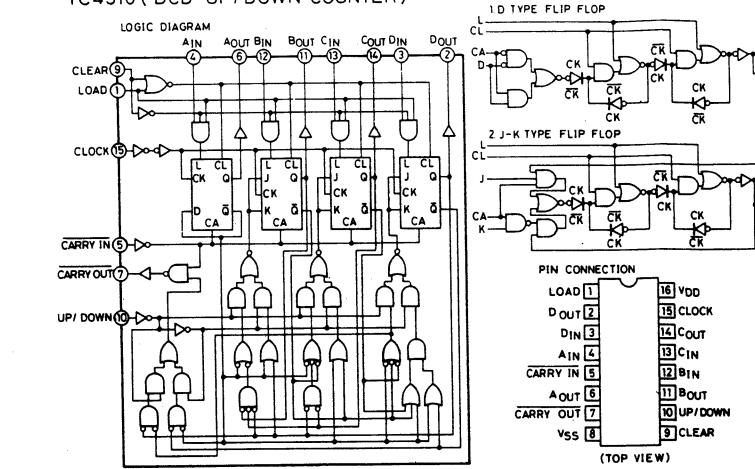
MOTOR CONTROL (PITCH & PLL) SYSTEM DIAGRAM



IC BLOCK DIAGRAM

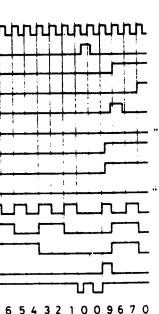
TC 4510

TC4510 (BCD UP/DOWN COUNTER)



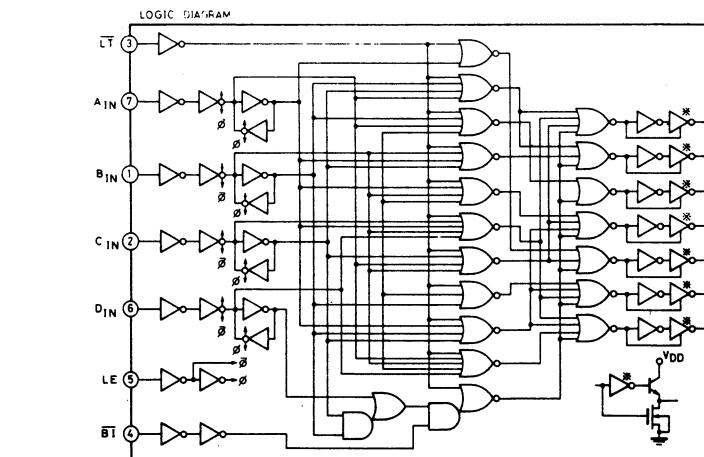
CARRY IN	UP/DOWN	LOAD	CLEAR	OUTPUT
H	*	L	L	NO COUNT
L	H	L	L	UP COUNT
L	L	L	L	DOWN COUNT
*	*	H	L	RESET
*	*	*	H	CLEAR

* Don't Care



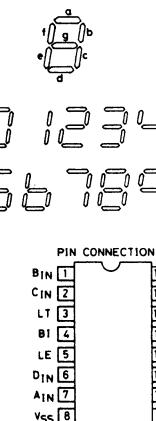
TC 4511

TC4511 (BCD TO 7-SEGMENT LATCH/DECODER/DRIVER)



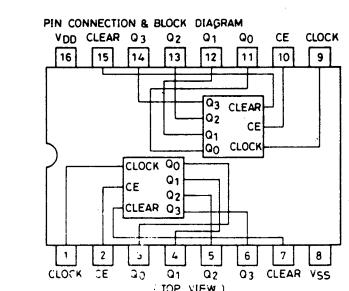
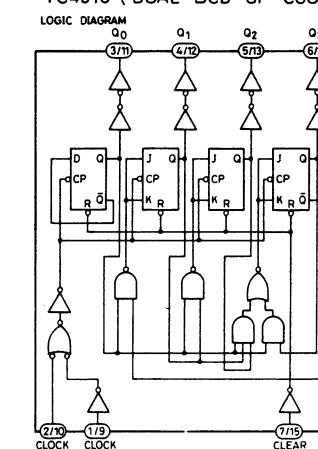
INPUT	OUTPUT	DISPLAY MODE
L E B1 LT D C B A a b c d e f g	8	
* * L * * * * H H H H H H H H	BLANK	
L H H L L L L H H H H H H H H	0	
L H H L L L L H H H H H H H H	1	
L H H L L L L H H H H H H H H	2	
L H H L L L L H H H H H H H H	3	
L H H L L L L H H H H H H H H	4	
L H H L L L L H H H H H H H H	5	
L H H L L L L H H H H H H H H	6	
L H H L L L L H H H H H H H H	7	
L H H L L L L H H H H H H H H	8	
L H H L L L L H H H H H H H H	9	
L H H L L L L H H H H H H H H	BLANK	
L H H L L L L H H H H H H H H	BLANK	
L H H L L L L H H H H H H H H	BLANK	
H H H H * * * * * * * * * * * * * * * *	△ △	

*: Don't Care △: Depends upon the BCD code previously applied when LE = "L"

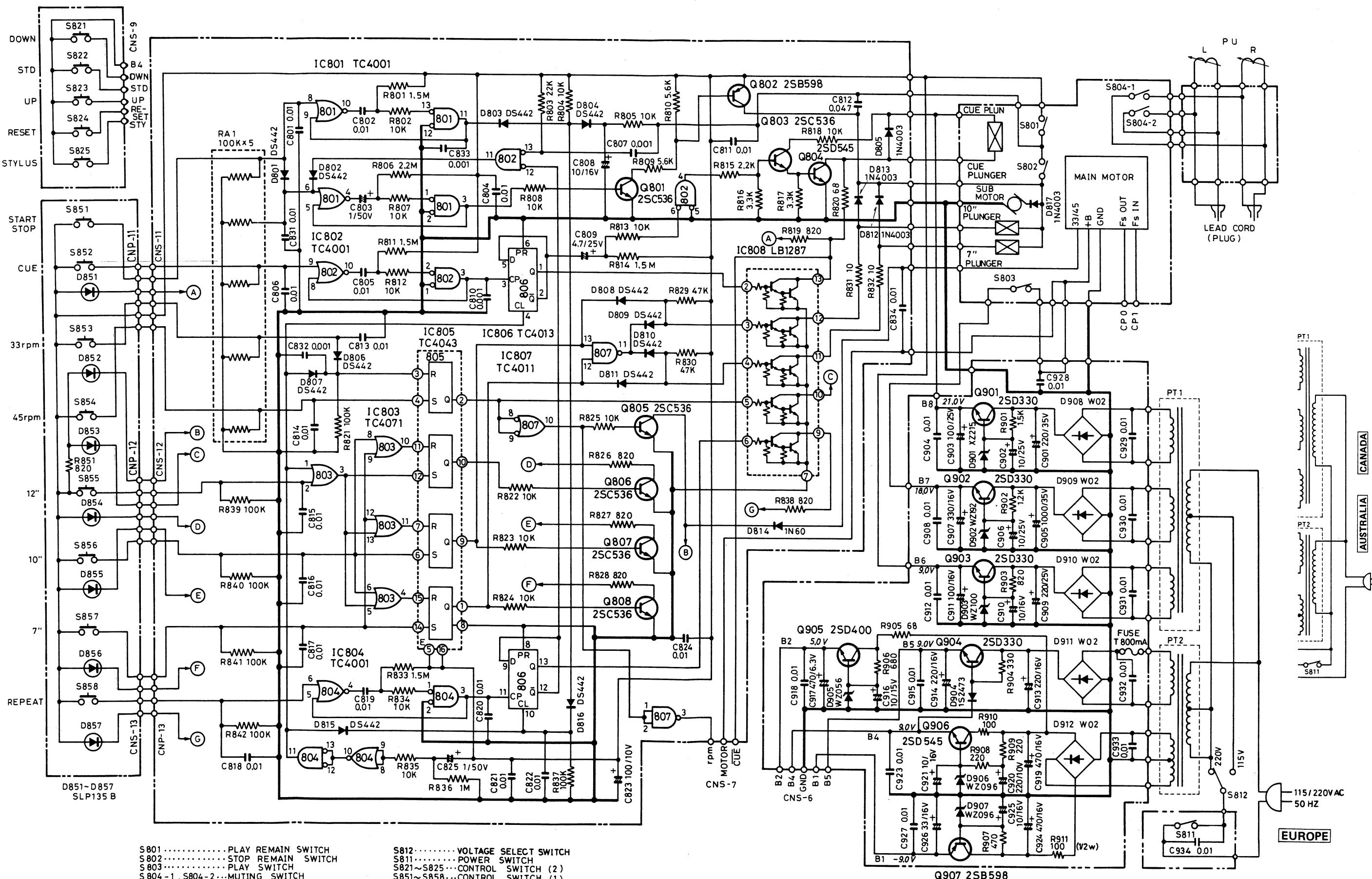


TC 4518

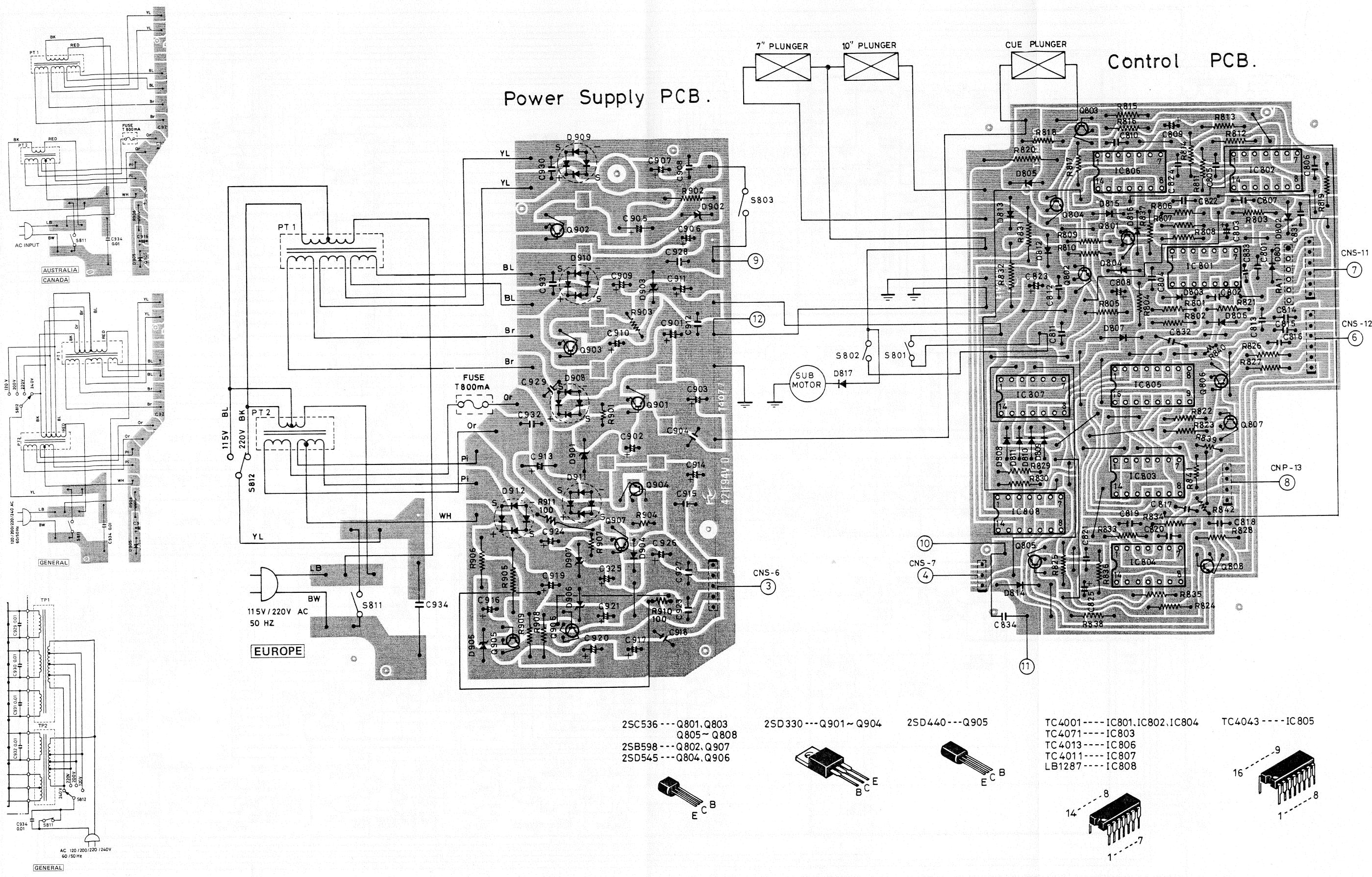
TC4518 (DUAL BCD UP COUNTER)



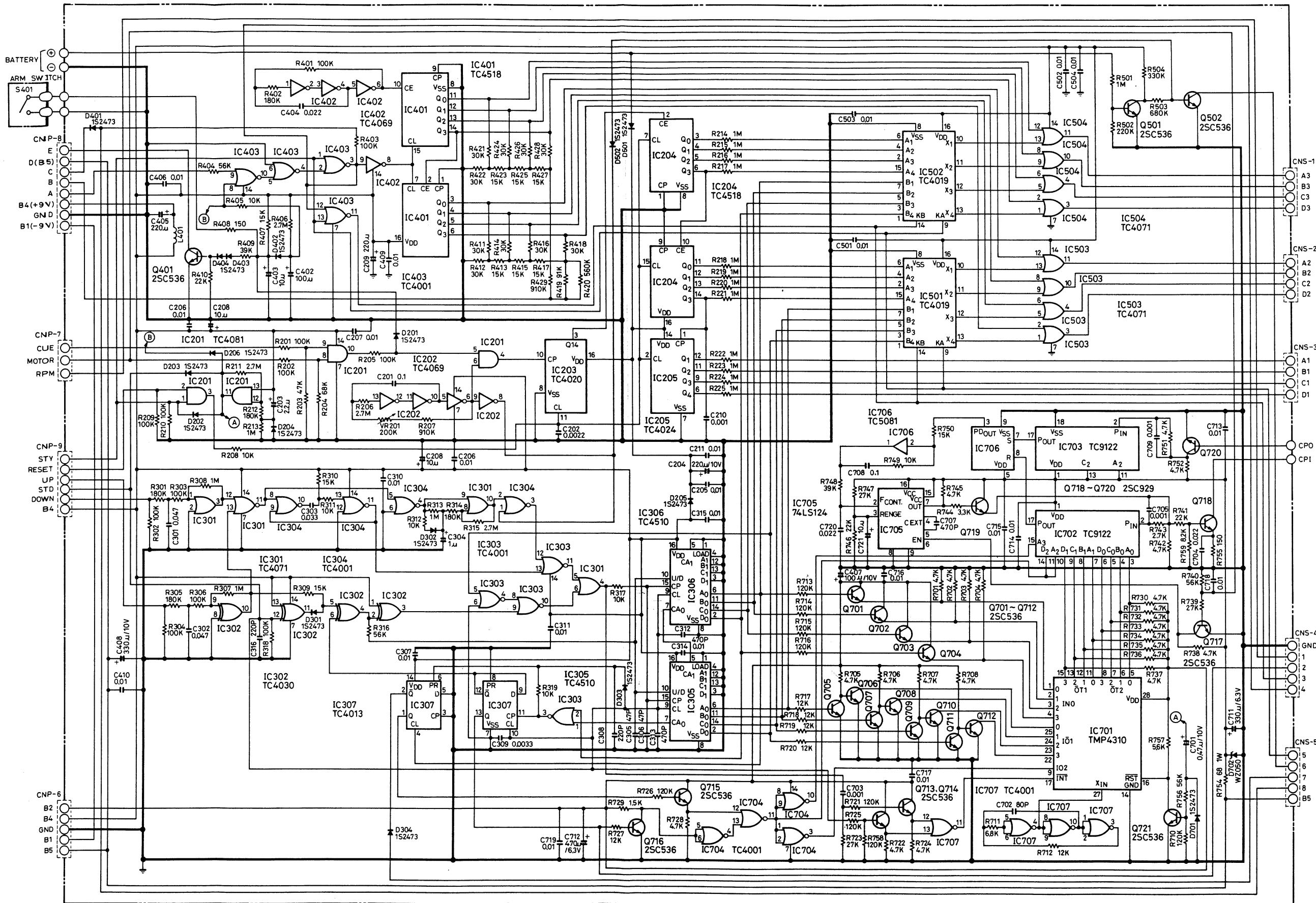
SCHEMATIC DIAGRAM (CONTROL)



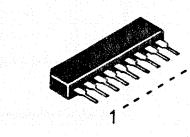
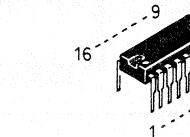
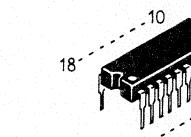
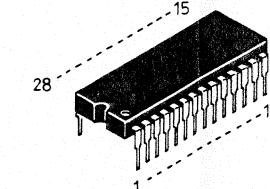
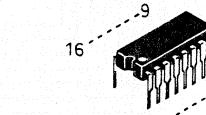
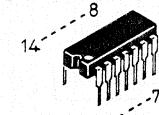
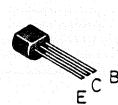
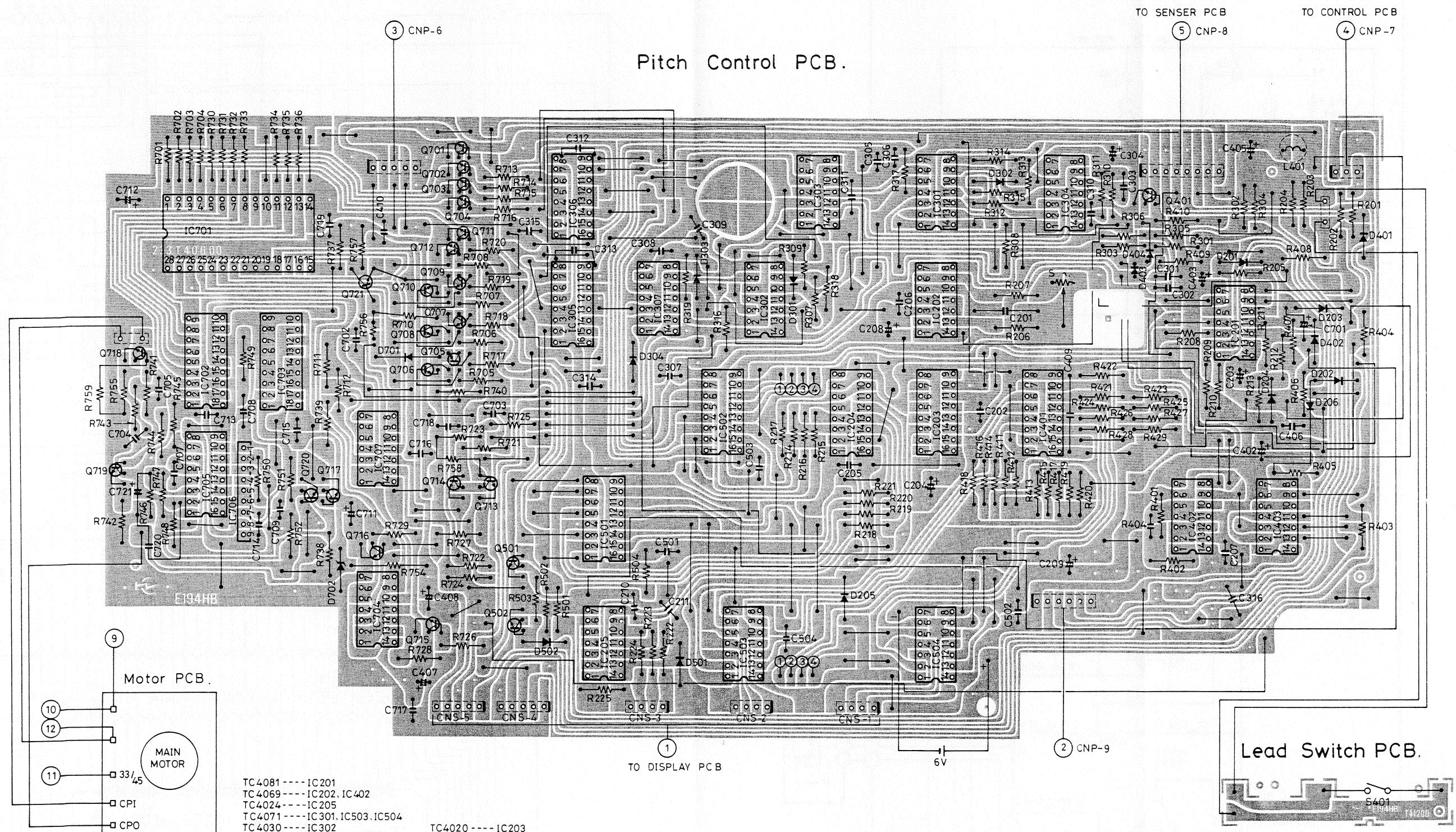
WIRING DIAGRAM (CONTROL, POWER SUPPLY)



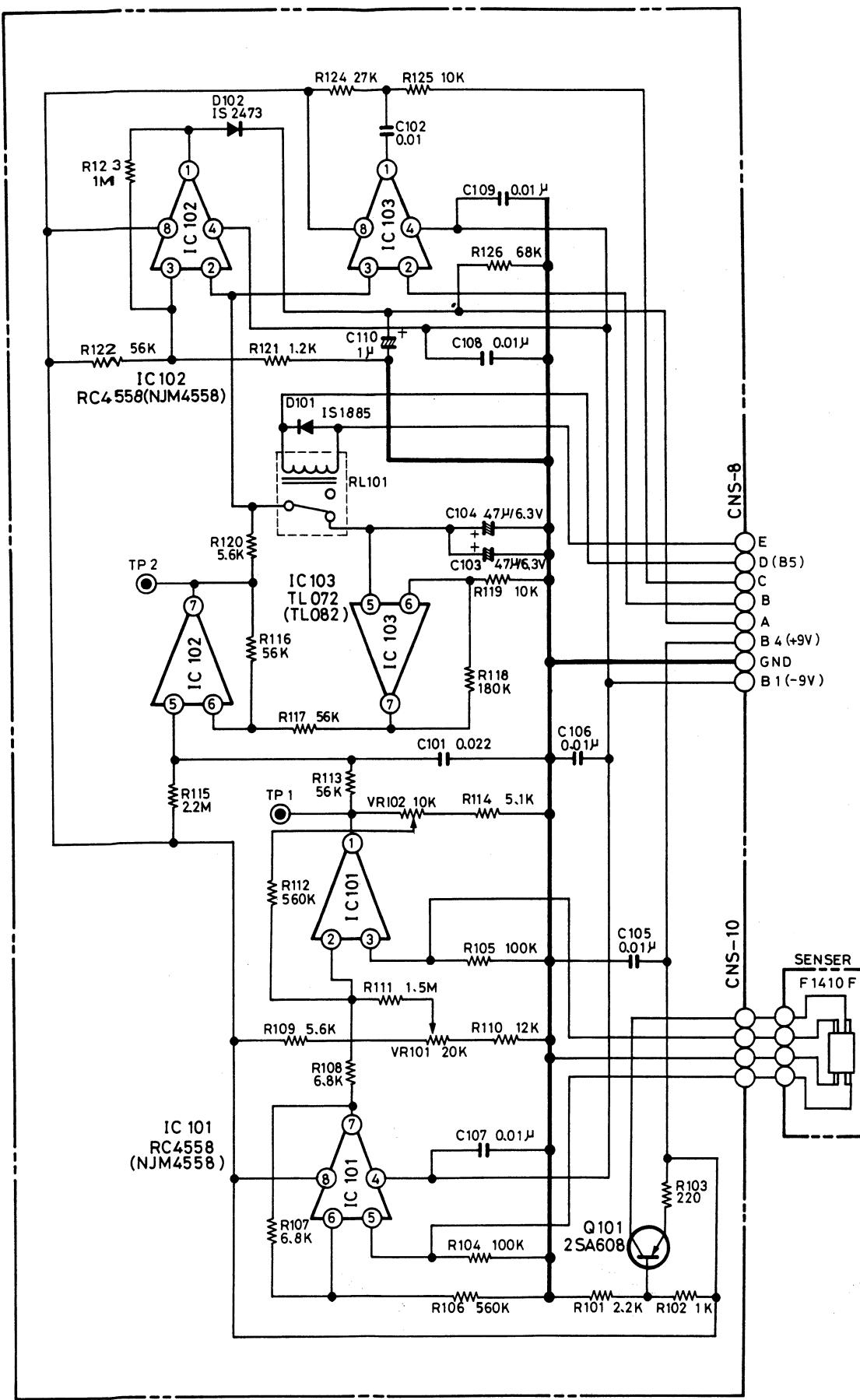
SCHEMATIC DIAGRAM (PITCH CONTROL)



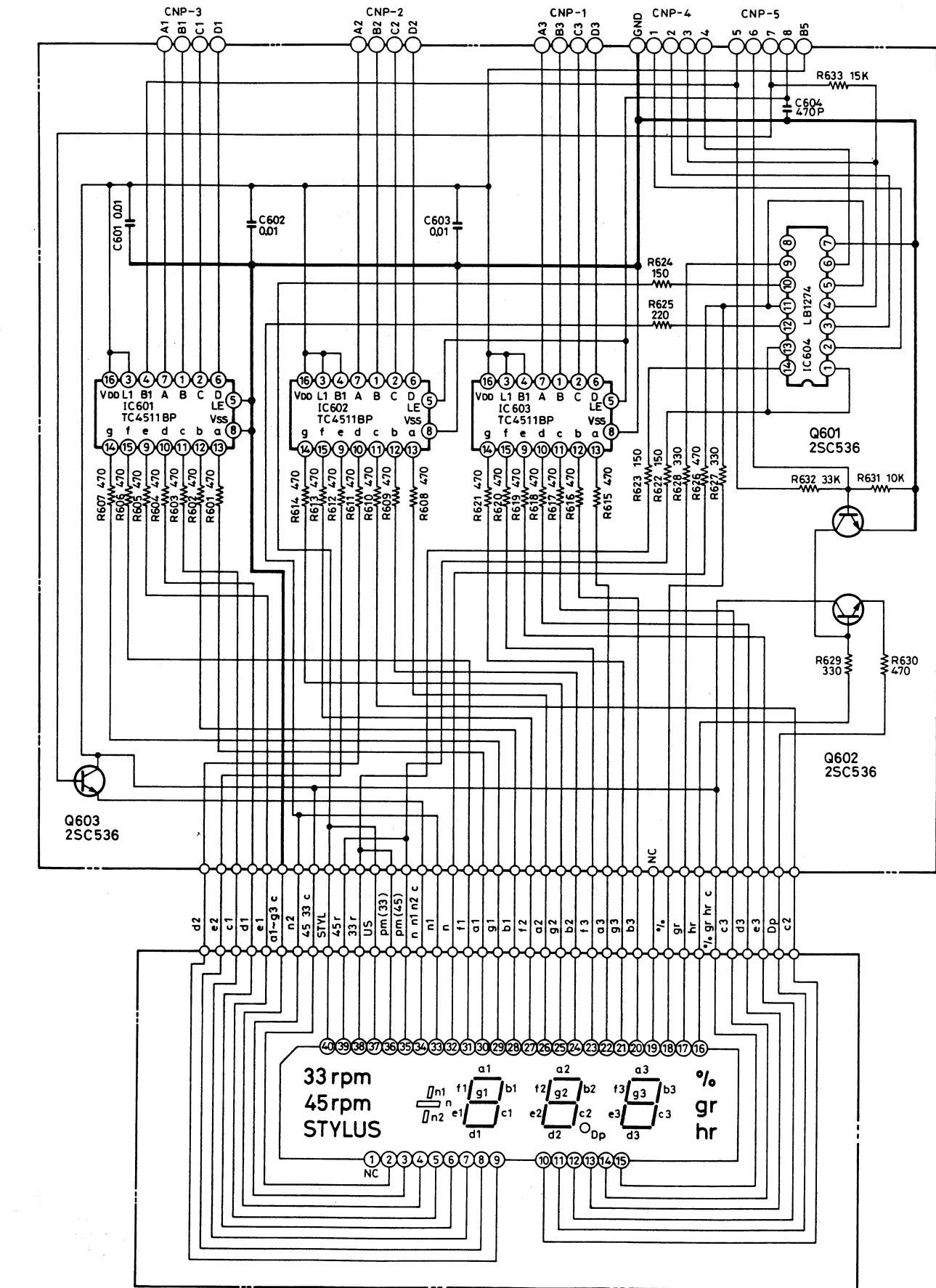
WIRING DIAGRAM (PITCH CONTROL)



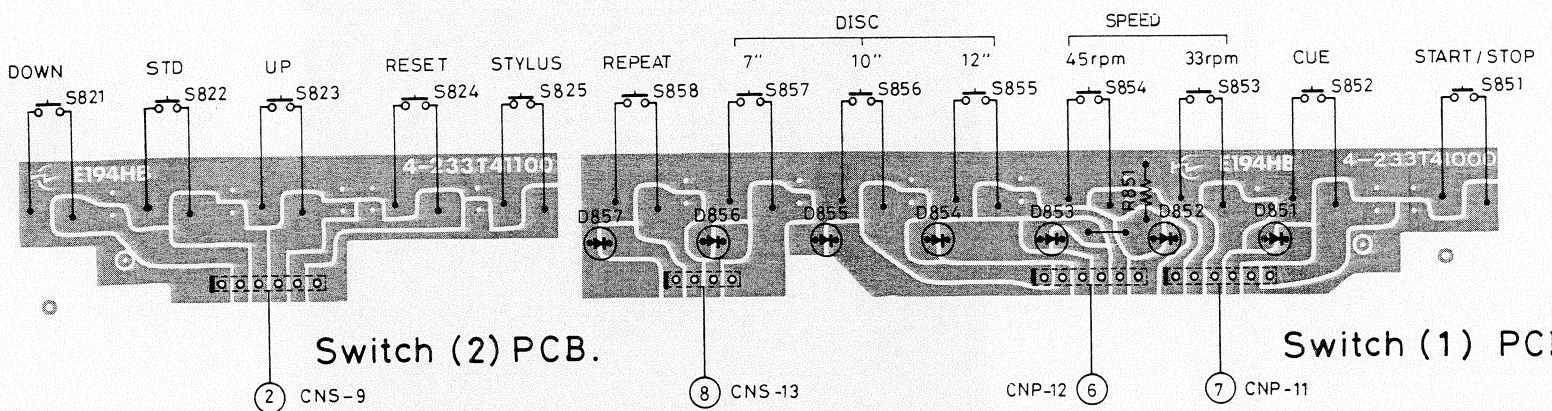
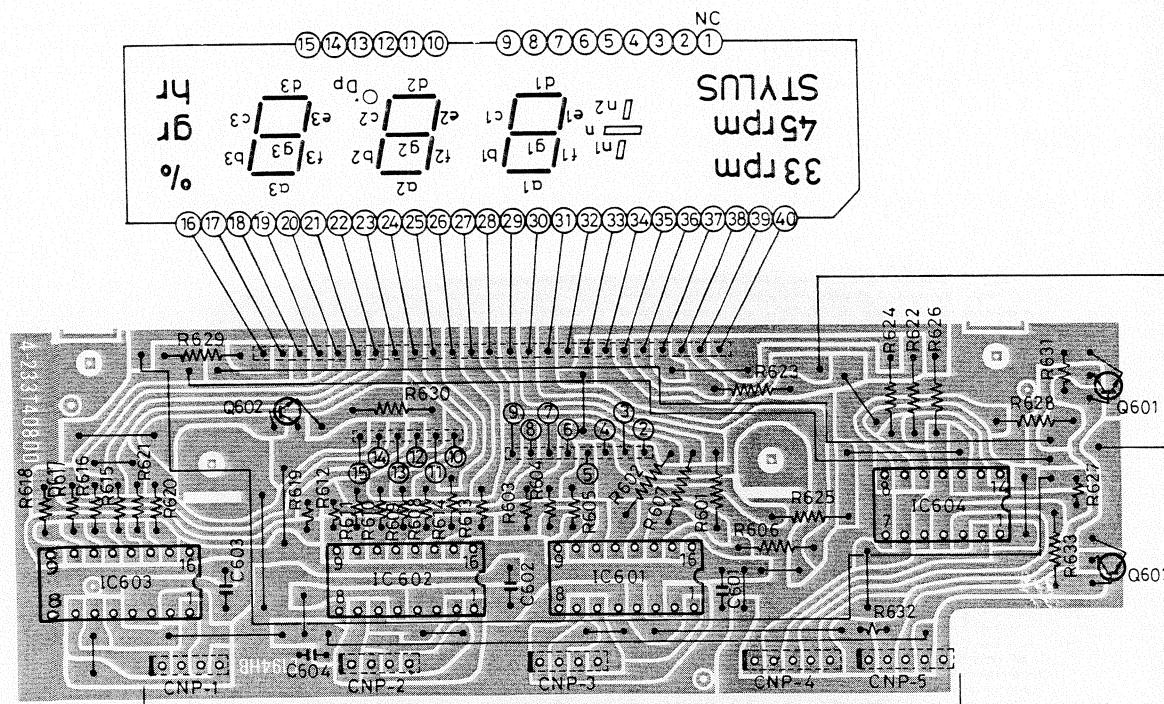
SCHEMATIC DIAGRAM (SENSOR AMP.)



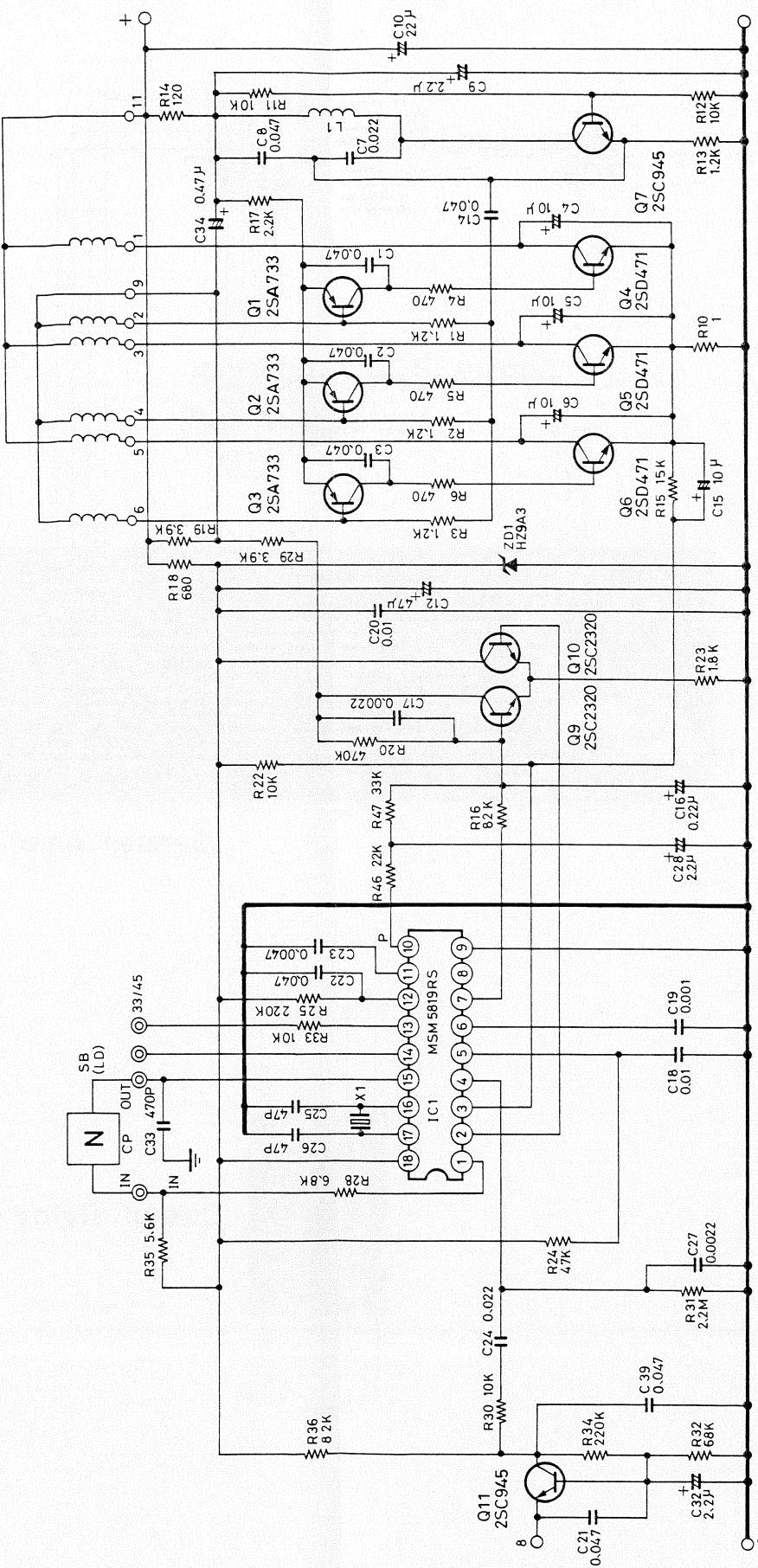
SCHEMATIC DIAGRAM (DISPLAY)



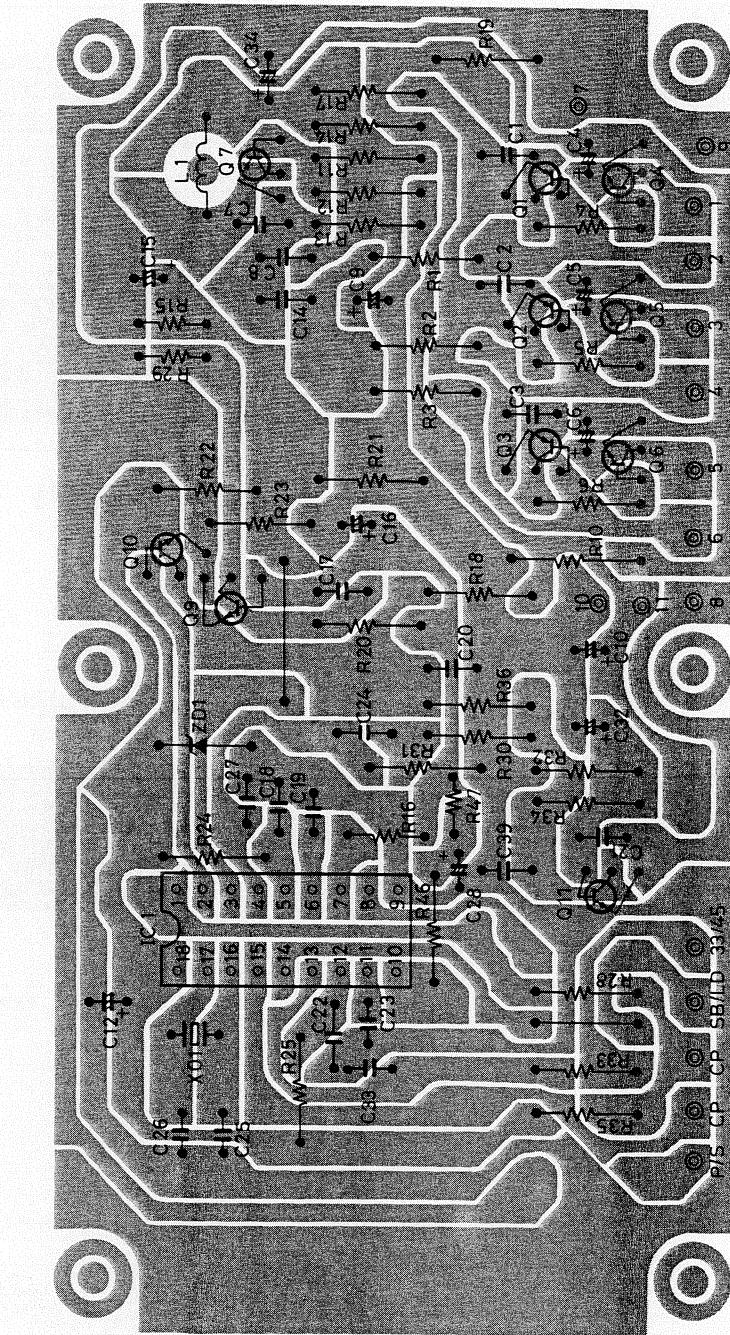
WIRING DIAGRAM (SENSOR AMP. · DISPLAY)



SCHEMATIC DIAGRAM (MOTOR)



WIRING DIAGRAM (MOTOR)



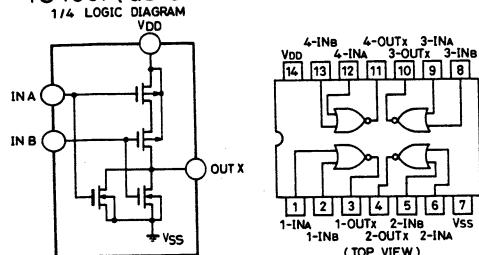
Moter PCB.

2SA733 --- Q1, Q2, Q3
 2SD471 --- Q4, Q5, Q6
 2SC945 --- Q7, Q11
 2SC2320 --- Q9, Q10

MSM5819 --- IC1

IC BLOCK DIAGRAM

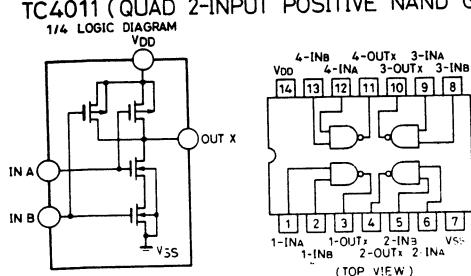
TC 4001 TC4001 (QUAD 2-INPUT POSITIVE NOR GATE)



TRUTH VALUE TABLE

INPUT	OUTPUT
A B	X
L L	H
L H	L
H L	L
H H	L

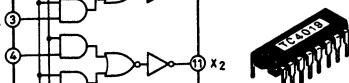
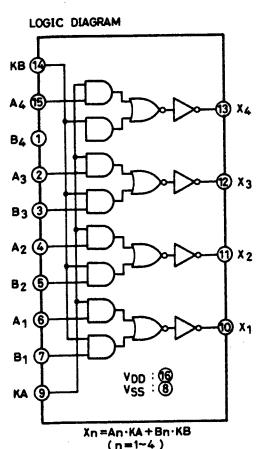
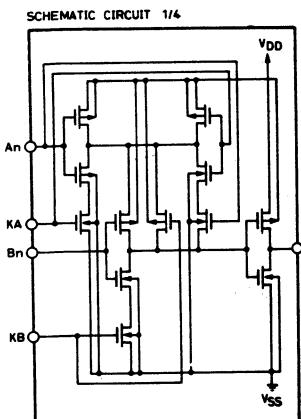
TC 4011 TC4011 (QUAD 2-INPUT POSITIVE NAND GATE)



TRUTH VALUE TABLE

INPUT	OUTPUT
A B	X
L L	H
L H	H
H L	H
H H	L

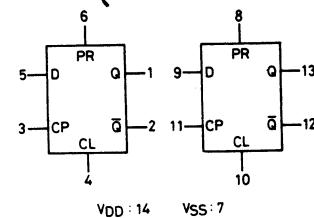
TC 4019 TC4019 (QUAD AND-OR SELECT GATE)



TC 4013

TC4013 (DUAL D-TYPE FLIP FLOP)

BLOCK DIAGRAM

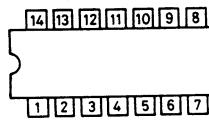
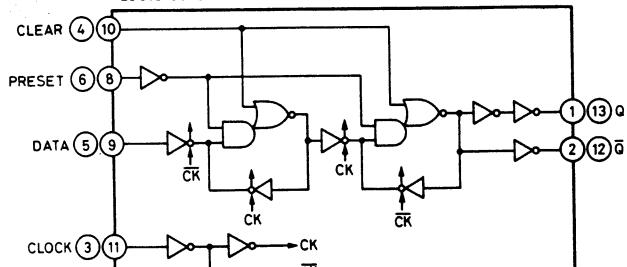


TRUTH TABLE

INPUTS			OUTPUTS	
CL	PR	D	CP Δ	Q _{n+1} \bar{Q}_{n+1}
L	H	\times	\times	H L
H	L	\times	\times	L H
H	H	\times	\times	L H
L	L	L	Δ	L H
L	L	H	Δ	H L
L	L	\times	Δ	Q _n \bar{Q}_n

\times : DON'T CARE
 Δ : LEVEL CHANGE
• : NO CHANGE

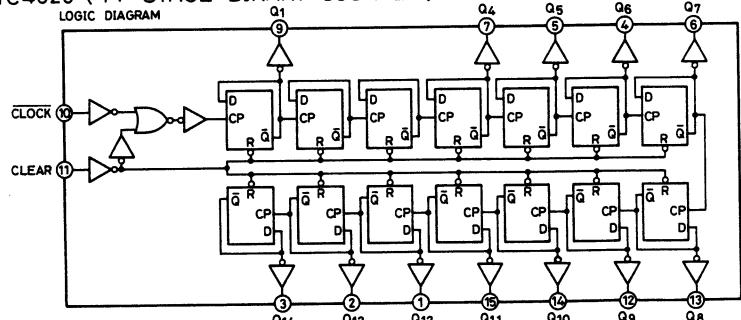
LOGIC DIAGRAM 1/2



TC 4020

TC4020 (14-STAGE BINARY COUNTER)

LOGIC DIAGRAM



PIN CONNECTION

Q ₁₂ (1)	16	V _{DD}
Q ₁₃ (2)	15	Q ₁₁
Q ₁₄ (3)	14	Q ₁₀
Q ₆ (4)	13	Q ₈
Q ₅ (5)	12	Q ₉
Q ₇ (6)	11	CLEAR
Q ₄ (7)	10	CLOCK
V _{SS} (8)	9	Q ₁

TRUTH TABLE

CLOCK Δ	CLEAR	OUTPUT STATE
\times	H	All Outputs = "L"
Δ	L	No Change
\square	L	Advance to Next State

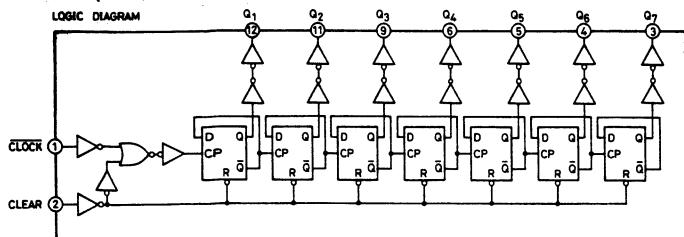
Δ : Level Change
 \times : Don't Care



IC BLOCK DIAGRAM

TC 4024

TC4024 (7-STAGE BINARY COUNTER)



PIN CONNECTION

CLOCK	1	14	VDD
CLEAR	2	13	NC
Q7	3	12	Q1
Q6	4	11	Q2
Q5	5	10	NC
Q4	6	9	Q3
VSS	7	8	NC

(TOP VIEW)

TRUTH TABLE

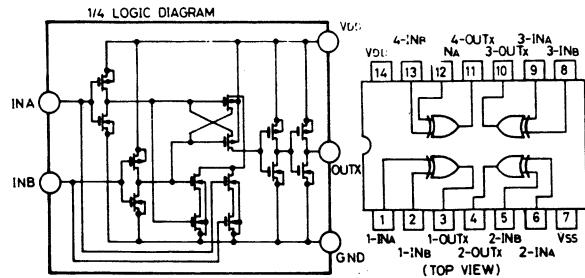
CLOCK	CLEAR	OUTPUT STATE
*	H	All Outputs = "1"
—	L	No Change
—	L	Advance to Next State

△ Level Change
X Don't Care



TC 4030

TC4030(QUAD 2-INPUT EXCLUSIVE OR GATE)

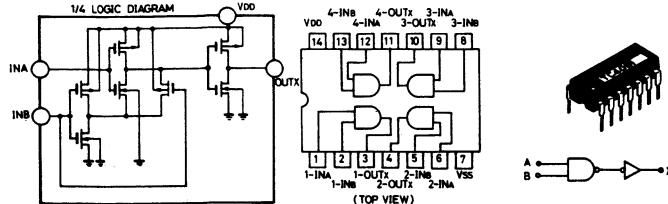


C-MOS

INPUT	OUTPUT
A	B
L	L
L	H
H	L
H	H

TC 4081

TC4081(QUAD 2-INPUT POSITIVE AND GATE)

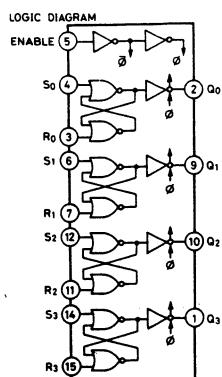


C-MOS

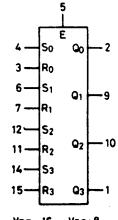
INPUT	OUTPUT
A	B
L	L
L	H
H	L
H	H

TC 4043

TC4043BP (QUAD POSITIVE NOR R/S LATCH)



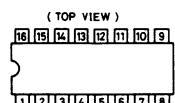
BLOCK DIAGRAM



TRUTH TABLE

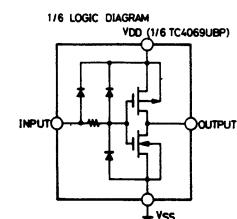
S	R	E	Q
*	*	L	HZ
L	L	H	NO CHANGE
L	H	H	L
H	L	H	H
H	H	H	H

* : DON'T CARE
HZ : HIGH IMPEDANCE

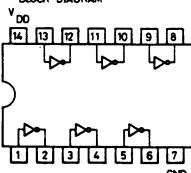


TC 4069

TC4069 (HEX INVERTER)



BLOCK DIAGRAM



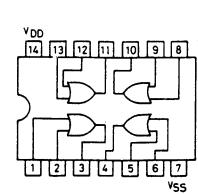
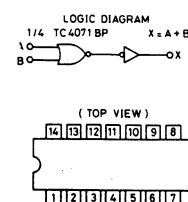
TRUTH VALUE TABLE

INPUT	OUTPUT
—	—
L	H
H	L

$$A \rightarrow \overline{A}$$

TC 4071

TC4071BP (QUAD 2-INPUT POSITIVE OR GATE)



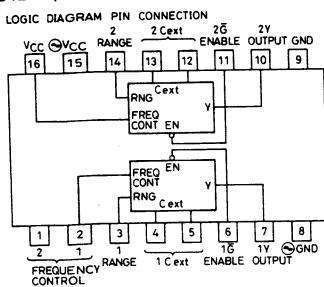
TRUTH VALUE TABLE

INPUT	OUTPUT
A	B
L	L
L	H
H	L
H	H

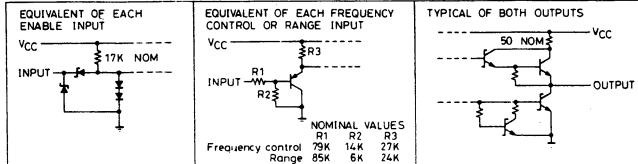
IC BLOCK DIAGRAM

SM 74LS124

SN74LS124 (DUAL VOLTAGE-CONTROLLED OSCILLATOR)

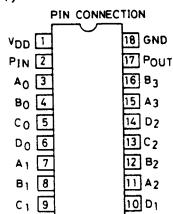
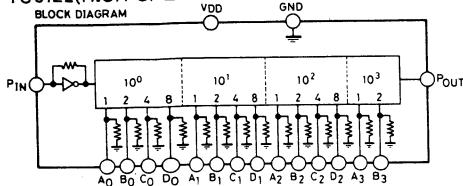


SCHEMATICS OF INPUT and OUTPUT



TC 9122

TC9122(HIGH SPEED BCD PROGRAM-COUNTER/DIVIDER)



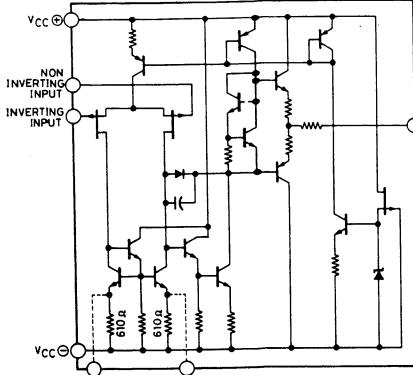
Function of each terminal

Pin No.	Symbol	Name	Function	Remarks
2	P _{IN}	Programmable counter input terminal.	Input terminal of signal to be divided down in programmable counter	Amplifier built in.
3~16	A ₀ ~D ₀ A ₁ ~D ₁ A ₂ ~D ₂ A ₃ , B ₃	x 10 ⁰ x 10 ¹ x 10 ² x 10 ³	Program input terminal Input terminals to set dividing ratio N in BCD. Possible up to 8 to 3999 in 3-1/2 dividing ratio are prohibited. The following combinations of dividing ratio are prohibited. A ₀ ⁰ B ₀ ⁰ C ₀ ⁰ D ₀ ⁰ A ₁ ⁰ B ₁ ⁰ C ₁ ⁰ D ₁ ⁰ A ₂ ⁰ B ₂ ⁰ C ₂ ⁰ D ₂ ⁰ A ₃ ⁰ B ₃ ⁰ 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	Pull-down resistance is built in each terminal.
17	P _{OUT}	Programmable counter output terminal	Output terminal of programmable counter. To be output of frequency of I/N of P _{IN} input frequency.	
1,18	V _{DD} GND		Terminals to which supply voltage is applied.	

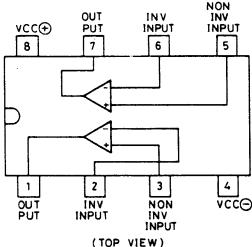
TL 072

TL072 (LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIER)

1/2 SCHEMATIC CIRCUIT



PIN CONNECTION & BLOCK DIAGRAM

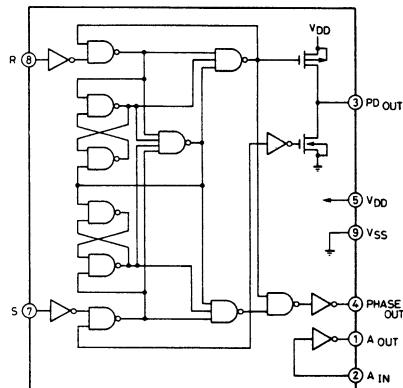


COMPONENT VALUES SHOWN ARE NOMINAL

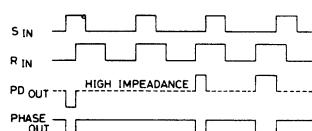
TC 5081

TC5081 (PHASE COMPARATOR)

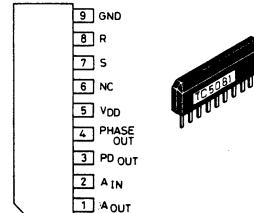
LOGIC DIAGRAM



TIMING CHART



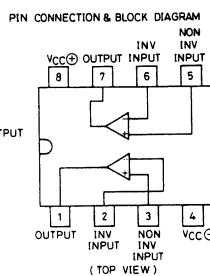
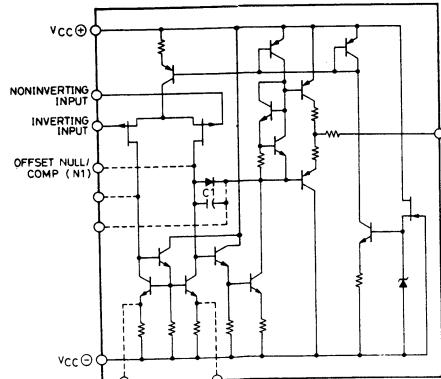
PIN CONNECTION



TL 082

TL082 (JFET-INPUT OPERATIONAL AMPLIFIER)

1/2 SCHEMATIC CIRCUIT



C11: 10pF ON TL081, TL082, TL083, TL084 AND TL085 ONLY
COMPONENT VALUES SHOWN ARE NOMINAL

SANYO ELECTRIC TRADING CO., LTD.

33, Hiyoshi-cho 2, Moriguchi-shi
Osaka-fu, 570, JAPAN

Jul./'80/2500 HA Printed in Japan